

Papers, please! The effect of birth registration on child labor and education in early 20th century USA



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Abstract

A birth certificate establishes a child's legal identity and age, but few quantitative estimates of the significance of birth registration exist. Birth registration laws were enacted by U.S. states in the 19th and early 20th centuries. Using 1910–1930 census data, this study finds that minimum working age legislation was twice as effective in reducing under-aged employment if children had been born with a birth registration law, with positive implications for school attendance. There is some evidence that registration laws also improved the enforcement of schooling laws for younger children. A retrospective analysis with the 1960 census shows that the long-term effect of registration laws was to increase educational attainment by approximately 0.1 years.

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1. Introduction

“The necessity for vital statistics is felt in nearly every phase of human existence. Especially is this true in matters of demography, in that of estates, in establishing property rights of inheritance, insurance and pensions. They are important factors in medico-legal sense, i.e. in their bearing upon the laws governing child labor, the age of consent etc.” (*State of Nevada, 1912, p. 37*). This quote from a Nevada Board of Health report for 1912 illustrates the growing recognition of the multiple uses and importance of records on vital events, such as birth certificates, in early twentieth century USA.

State-level laws and institutions for birth registration were established across U.S. states in the 19th and early

20th centuries. The purpose of these laws was to ensure that births were registered, records existed centrally and that certificates of birth were made available. Today, in most developed countries, the registration of native births is taken for granted. However, in many developing countries, a significant proportion of children are born and live unregistered (see e.g. [UNICEF, 2011](#)).

A birth certificate establishes a person's legal identity and functions as official proof of age (see e.g. [Todres \(2003\)](#)). Historians have discussed the significance of birth registration as an important, but neglected institution for economic development. [Szreter \(2007\)](#) describes the importance of parish registers in England between the 17th and 18th centuries in the process of verifying property and inheritance rights as well as social security claims (the Poor Laws). [Higgs \(1996\)](#) suggests that the need to clarify property rights lies behind the establishment of civil registration systems in Britain in the 19th century. The

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timely registration of births and deaths generates accurate figures on the population and the prevalence of disease and mortality and is therefore considered important from a medical perspective (see e.g. Mahapatra et al., 2007). However, statistical studies establishing causal connections between registration systems and economic and social outcomes hardly exist (see Corbacho et al., 2012 for a recent exception).

This study provides a quantitative analysis of the relevance of birth registration laws for the enforcement of child labor and schooling laws in a historical context, focusing on early 20th century USA. It examines whether legal age requirements were more effective in reducing under-aged employment and in raising school attendance of school-aged children, when birth certificates were available as proof of age.

The incidence of child labor in the U.S. declined significantly in the early 20th century. The roles played by compulsory schooling laws and child labor laws in either educational attainment, or in the incidence of child labor in the U.S., have been studied previously (see e.g. Angrist and Krueger, 1991; Brown et al., 1992; Goldin and Katz, 2011; Lleras-Muney, 2002; Manacorda, 2006; Margo and Finegan, 1996; Moehling, 1999; Osterman, 1979). Econometric studies indicate that the laws may have been relevant for raising education levels, or for reducing child employment, but that their contribution was not large. Child labor and schooling laws have also been used as instrumental variables for education in studies on the effects of education on outcomes such as crime, mortality and voting (e.g. Lleras-Muney, 2005; Lochner and Moretti, 2004; Milligan et al., 2004). However, the economic literature on these laws has so far ignored the role of birth registration in the enforcement of such legislation.²

The core part of the analysis in this study utilizes individual-level data from 1% samples of three U.S. federal censuses: for 1910, 1920 and 1930 (IPUMS-USA, Ruggles et al., 2010). The 1960 census is also used to study the longer term implications for educational attainment. The census does not contain information on whether the birth of an individual had been registered. However, support for the argument that individuals were significantly more likely to have had their births registered if they had been born after the enactment of a state birth registration law, can be found in historical documents. At this point in time, if births were registered,

this happened early in the child's life. Delayed registration of births was not a standard practice until the early 1940s in the U.S., when economic necessities led to states adopting standard procedures for delayed birth registration (see Hetzel, 1997; Landrum, 2010).

The econometric analysis exploits the difference in the timing of the enactment of state birth registration laws across states. Whether a child was born with a registration law in place depended on his, or her, year of birth and state of birth. The minimum working age and compulsory schooling age varied depending on the child's state of residence and sample year. The effects of registration laws are identified using models that control for state and cohort specific effects as well as linear state-specific trends. Therefore, the identifying assumption is that non-linear trends in unobservable state-specific variables are not correlated with the timing of birth registration laws. Models with additional time-varying control variables are estimated and specific falsification tests conducted to analyze the validity of the assumption.

The analysis on child labor focuses on the 1910–1930 census data and on 12–15 year old children. The findings suggest that the minimum working age legislation did reduce the tendency of under-aged children to work in relation to the work-eligible. However, the law was at least twice as effective when children had been born during or after the year when their state of birth had enacted a birth registration law. Those below the minimum working age were also more likely to report having attended school when they had been born with rather than without a birth registration law in place.

The compulsory schooling age is not found to be a relevant factor for child employment, or school attendance for 12–15 year olds, after minimum working age is controlled for. The inclusion of birth registration laws in the analysis does not change the conclusion. However, in the case of younger children (6–11 year olds), those who had reached the compulsory schooling age were more likely to report attending school if they had been born with a registration law in place. Finally, the 1960 U.S. census is used to show that among individuals born between 1896 and 1925, those born with a birth registration law had approximately 0.1 more years of education than those born before a birth registration law.

2. Birth registration laws and child labor and schooling laws in the U.S.

2.1. Development of birth registration systems

The roots of modern registration systems in the USA lie in the need for statistics for medical purposes in the

² In this connection it should be noted that the author is aware of an unpublished study by Puerta (2010) on the effects of child labor laws on the value added in the U.S. manufacturing sector, where a robustness check takes into account whether the child labor law required documentary proof of age.

19th century. Rapid urbanization, accompanied by a spread of epidemics, led health officials to advocate for more accurate statistics on the incidence of births and deaths (see [Hetzel, 1997](#)). Initially, the attention centered on death registration, but systems for birth registration developed alongside those for death registration. Over several decades, the adoption of state-wide registration practices spread gradually across U.S. states. The National Board of Health, established in 1879 and state boards of health played an important role in the advancement and implementation of state-wide registration practices (e.g. [Hetzel, 1997](#)). Beyond medical interest, the development of birth registration systems can also be considered an element of Progressive-era child welfare reforms (see also [Landrum, 2011](#)). According to [Hetzel \(1997\)](#), p. 52, “The Federal Children’s Bureau, created in 1912, worked actively with the Census Bureau in many of the State (registration) campaigns.”

The aims of state registration laws were broadly to enable birth registration and make it mandatory, standardize registration practices, provide uniform birth certificates and establish central repositories of birth certificates, which would facilitate their use ([Hetzel, 1997](#); [Shapiro, 1950](#)). The beginning of state-wide registration was instrumental for the advancement of birth registration, and the eventual achievement of full registration coverage.

States may have had some practices for recording births prior to the state birth registration laws, but this varied significantly across and within states. Registration may have been carried out in specific counties, or in certain cities, but the coverage was generally weak (see [Eichholz, 2004](#); [Nichols, 1980](#)).³ In a discussion on early attempts of registration in the 17th and 18th centuries, [Hetzel \(1997\)](#), p. 45 notes that “although a few cities and towns maintained active registration, for many years not a single State could be said to have a system covering its entire area”. Although full registration coverage was not reached immediately, reports from several state Boards of Health for periods before and after the enactment of the state registration laws indicate significant changes in registration practices. A discussion of this evidence, including extracts from such reports can be found in [Appendix 1](#).

Massachusetts is regarded as the first state to pass a “modern” state-level law requiring that births and

deaths are registered in 1841 ([Shapiro, 1950](#)).⁴ The process by which states enacted laws making birth registration mandatory was a gradual one. [Hetzel \(1997\)](#), p. 53 cites a National Resources Committee report as follows: “in some States, the boards of health had to be educated to the need, before the citizens of that State could approach the legislature. In others, the legislatures were apathetic, in spite of strong pressures...”.

Significant progress in the enactment of statewide registration is considered to have taken place when the model registration bill was drafted in 1907. According to [Shapiro \(1950\)](#), p. 91, this Model Vital Statistics Act specified the “central authority of the State boards of health over registration matters, provided for the establishment of a strong local apparatus, fixed responsibility for registering births on the attendant at birth (physician, midwife),⁵ called for rigid enforcement of the law, and listed a minimum set of items for inclusion on State certificates”.⁶ Pennsylvania adopted a draft version of this bill in 1905, which came into force in 1906, and according to [Shapiro \(1950\)](#), the improvements in birth registration were “immediate”. Several other states followed suit.

Perfect enforcement of the state laws, or full coverage of birth registration, were not achieved overnight. In some cases, early state laws did not include penalties and were therefore potentially less effective in registering the population (see [Nichols, 1980](#)). Limited access to registration facilities, birth outside health care facilities, or parental ignorance, are likely to have affected registration coverage. Estimates for 1940 showed that while 94% of white births were estimated to be registered, the corresponding figure was 81.5% for black births. The registration rate of urban births was 9.5 percentage points higher than that of rural births, likely to be driven by the lower rates of births in health care facilities in rural areas (see [Shapiro, 1950](#)).

The National Birth Registration area was established in 1915 to stimulate progress in birth registration. States were provided support nationally to improve registration systems. Ten states (in north-eastern and north central parts) and the District of Columbia were originally included ([Shapiro, 1950](#)). The criteria for the initial

³ Any existing records may also have been destroyed by the time a state law came into place, making it impossible to obtain copies (see e.g. [Clopper, 1918](#) for the case of Alabama).

⁴ [Landrum \(2011\)](#) explains that by 1861 in Massachusetts, town clerks were incentivized by payments for each birth they reported to the state and fined for not registering births. Parents could be fined up to 5 dollars for not reporting a birth.

⁵ According to [Landrum \(2011\)](#), the model law specified that doctors and midwives were not allowed to collect a fee for filing a certificate with the local registrar. They faced penalties for not undertaking this duty.

⁶ See [Hetzel \(1997\)](#), p. 28 for a table on the content of a U.S. standard birth certificate across time since 1900.

inclusion are somewhat unclear, but from thereafter states were included when 90% of births were estimated to be registered (Shapiro, 1950). It is not possible to obtain adequate estimates of registration coverage from the year of the law for each state, in each year.⁷

Prior to the early 1940s, regulation, or procedures for delayed birth registration were either missing, or slow and complex, which strongly inhibited late registration (see Hetzel, 1997).⁸ According to estimates, in 1940 the births of nearly 55 million Americans⁹ had never been registered (Hetzel, 1997). Only in 1941 that the Census Bureau designed a manual on procedures for delayed registration, which were then adopted by a large number of states (Hetzel, 1997). The implication is that in the absence of a functioning system for delayed registration, there was a high likelihood that a child, who was not registered at birth, or shortly after, remained unregistered, until the early 1940s.¹⁰

Several sources are used to establish the year of the birth registration law for each state. These are discussed in detail in Appendix 1. Table 1 presents the year of the law that established statewide mandatory birth registration (column 1). It also includes the year that each state was incorporated into the National Birth Registration area (column 2) and the year from which onwards the State Office of Vital Statistics holds records of births

(column 3).¹¹ A histogram of the timing of the birth registration laws is presented in Fig. 1. In over 70% of the states, the law was passed after 1900.

2.2. Child labor laws and compulsory schooling laws

Given the breadth of the literature on child labor and compulsory schooling laws, only key studies on the effects of the laws on education and child employment in the U.S., can be mentioned.

Moehling (1999) finds that the minimum working age limit did not reduce the likelihood of child employment in manufacturing, or any occupation, in the U.S. between 1880 and 1900. It may have been more effective between 1900 and 1910. Lleras-Muney (2002) uses a range of indicators for child labor and schooling laws for 1915–39 and with the 1960 U.S. census, finds that one additional required year of schooling raised educational attainment by about 0.05 years.¹² Manacorda (2006) shows that there is a connection between child labor laws and child employment with the 1920 U.S. census. Goldin and Katz (2011) focus on requirements on the length of schooling, either for employment, or school drop-out, and the presence of continuation schooling laws. With the 1960 U.S. census, they find that together these laws did affect enrollment and attainment, but explain at most around 6–7% of the increase in either. The broad conclusion emerging from these studies is that although child labor laws and compulsory schooling laws had an effect on education, or child labor, these effects were not particularly large. Compulsory schooling laws have been used more broadly to study the economic and social effects of additional education in different contexts (see e.g. Card, 2001; Lochner, 2011).

The data on the schooling and child labor laws used in this study come from Goldin and Katz (2011). They involve contributions also from Schmidt (1996) and Lleras-Muney (2002). Data are available primarily for 1910–39, with the exceptions of the legal school leaving and entry age, for which data are available for 1900–1939.¹³ Child labor and schooling laws evolved over time and varied across states.¹⁴

The minimum legal working age in Goldin and Katz (2011) is defined as “the minimum legal age for

⁷ Some estimates of the completeness of birth registration can be found in academic publications for the period after the establishment of the National Birth Registration Area (see Whelpton, 1934 for estimates for 1930 and 1919/20). These are based on comparisons of the number of 0–1 year olds in the decennial census and the number of recorded births for different states. However, the census only takes place every 10 years. Data on recorded births are commonly available and published for those states that were a part of the National Birth Registration Area, which was established in 1915. These states already had high registration rates, and in many cases, the laws were enacted prior to 1915; in some considerably so. Therefore, no attempt is made to replicate such estimates here.

⁸ See Landrum (2010) for a discussion on how the requirement of the war industry to employ U.S. citizens led to a dramatic increase in the demand for delayed birth certificates by adults in the early 1940s.

⁹ The total US population in 1940, including foreign born individuals, was 132,164,569. Source: 1990 Census of Population and Housing, “1990 Population and Housing Unit Counts: United States”, (CPH-2).

¹⁰ As an example of the complexities of delayed registration, Landrum (2010) describes the case of California, where delayed registration was only possible through a complicated court proceeding with fees high enough to discourage most ordinary workers. As an indication of the lack of a functioning delayed registration system prior to the 1940s, Landrum refers for instance to the case Illinois, where over half a million applications for delayed certificates were processed between 1941 and 1943. Even if some children might have received delayed birth certificates prior to the 1940s, these would have been based on potentially unreliable, alternative proof of age.

¹¹ Analysis excludes Alaska, District of Columbia and Hawaii.

¹² An earlier unpublished dissertation by Schmidt (1996), analyzing compulsory schooling laws over a similar period, also finds effects on high school graduation rates.

¹³ The data can be accessed from <http://scholar.harvard.edu/goldin/pages/data> (version from July 2011).

¹⁴ The Fair Labor Standards Act, a federal child labor law, was only enacted in 1938 (see e.g. Moehling, 1999).

Table 1

Timing of statewide birth registration across U.S. states.

State	Birth registration law	Birth registration area	Records at State Vital Statistics Office
Alabama	1908	1927	January 1908
Arizona	1909	1926	July 1909
Arkansas	1914	1927	February 1914
California	1905	1919	July 1905
Colorado	1910	1928	1910
Connecticut	1897	1915	1897 ^a
Delaware	1913	1921	Mainly from 1913 ^b
Florida	1917	1924	January 1917 (some from 1865)
Georgia	1919	1928	January 1919
Idaho	1911	1926	July 1911 (some from 1907)
Illinois	1916	1922	January 1916
Indiana	1908	1917	October 1907
Iowa	1880	1924	July 1880
Kansas	1911	1917	July 1911
Kentucky	1911	1917	January 1911
Louisiana	1914	1927	From 1907 ^c
Maine	1892	1915	1923 (from 1892 in state archives)
Maryland	1898	1916	August 1898
Massachusetts	1841	1915	1841 ^d
Michigan	1867	1915	1906 (some from 1867)
Minnesota	1887	1915	January 1900
Mississippi	1913	1921	November 1912
Missouri	1910	1927	January 1910
Montana	1907	1922	Late 1907
Nebraska	1904	1920	Late 1904
Nevada	1911	1929	July 1911
New Hampshire	1883	1915	1640
New Jersey	1848	1921	1848 (1848–1900 in state archives)
New Mexico	1920	1929	1920
New York	1881	1915	1881
North Carolina	1914	1917	October 1913
North Dakota	1908	1924	1870 (incomplete over 1870–1920)
Ohio	1909	1917	20 December 1908
Oklahoma	1917	1928	October 1908 ^e
Oregon	1903	1919	1903
Pennsylvania	1906	1915	January 1906
Rhode Island	1853	1915	1853 ^f
South Carolina	1915	1919	January 1915
South Dakota	1905	1932	July 1905
Tennessee	1914	1927	January 1914
Texas	1903	1933	1903
Utah	1905	1917	1905
Vermont	1857	1915	State archives from 1716, incomplete up to 1909 ^g
Virginia	1912	1917	June 1912 (some for 1853–1896)
Washington	1907	1917	July 1907
West Virginia	1925	1925	January 1917

Table 1 (continued)

State	Birth registration law	Birth registration area	Records at State Vital Statistics Office
Wisconsin	1908	1917	Mainly October 1907
Wyoming	1909	1922	1909

Source: The determination of the year of the birth registration law relies on several sources (see Appendix 1 for details). Dates for the incorporation into the National Birth Registration Area (column 2) come from Hetzel (1997) Table 1.01, Appendix 2). The source for the year from which records are available at the State Office of Vital Statistics (column 3) is the National Center for Health Statistics/CDC (2013), but in the few cases with missing information, websites for relevant state offices are used (see below):

All websites last accessed in February 2013.

^a [http://www.ct.gov/dph/cwp/view.asp?](http://www.ct.gov/dph/cwp/view.asp?a=3132&q=388130&dphNav=46940)

^b <http://archives.delaware.gov/collections/vital.shtml>.

^c <http://new.dhh.louisiana.gov/index.cfm/page/649>.

^d <http://www.sec.state.ma.us/arc/arcgen/genidx.htm#pre1841>.

^e Also see http://www.ok.gov/health/Birth_and_Death_Certificates/Birth_Certificates/index.html.

^f Based on both Eichholz (2004); Nichols (1980).

^g <http://vermont-archives.org/research/genealogy/vitals/>.

obtaining a work permit for work during normal school hours". In states with minimum working age laws, children required a work permit and employers were responsible for holding these papers.¹⁵ Mechanisms to enforce child labor laws were strengthened in the early 20th century. According to Ogburn (1912) (cited by Moehling, 1999), by 1909, 34 states had enacted provisions for special inspectors to enforce child labor laws.¹⁶ According to Goldmark (1907), in 1907, in a large number of states, there were penalties in place for employers for the employment of under-aged children, and parents faced fines, or imprisonment for allowing an under-aged child to work, or for failing to send the child to school.

Compulsory schooling laws specified the minimum legal school entry and minimum school leaving ages. Over time, they also increasingly included requirements on the number of years of schooling to be completed, including exemptions for working children and requirements on continuation schooling.¹⁷ The first compulsory

¹⁵ According to Goldmark (1907), at the time of publication, the authority that issued "working papers" varied by state. She lists school officials, health officers, factory inspectors or judges as the options.

¹⁶ Goldmark (1907) also notes in many states, both truant officers and factory inspectors were authorized to "enter places of employment, to demand certificates of age or schooling...".

¹⁷ The presence of continuation schooling laws, also analyzed in Lleras-Muney (2002) and Goldin and Katz (2011), is controlled for in the retrospective analysis on educational attainment in Section 6. They applied to children, who were below the legal school leaving age, but were working and thus are dependent on employment.



Fig. 1. Histogram: Timing of the state birth registration laws in U.S. states.

schooling laws were enacted in the U.S. in the mid-19th century (Goldin and Katz, 2011), but they became more effective with investments in education and enforcement in the early 20th century (see e.g. Goldin and Katz, 2011; Lleras-Muney, 2002; Osterman, 1979 for details).

Often, the minimum legal school leaving age was higher than the minimum legal working age. However, states tended to waive requirements on compulsory schooling for working children who had reached the minimum working age. Depending on the state and the time period, working children may have been exempted subject to a minimum number of years of schooling for work, or the ability to read. According to Goldin and Katz (2011), the binding constraint for work for much of the 1910–1939 period, was the age at which a youth could obtain a work permit, or the schooling requirement for employment, if such was specified. In addition, non-working children below the minimum school leaving age could be exempted from school if they had completed a certain number of years.

Although previous studies (such as Goldin and Katz, 2011; Lleras-Muney, 2002) have exploited legal requirements on the years of schooling, this study relies largely on the legal age requirements. Only age requirements are strictly relevant for studying how birth registration influences the verification of age. The specific hypotheses tested are discussed in more detail in Section 3.

Lleras-Muney (2002) investigates the economic correlates of child labor and schooling law indicators. She finds a relationship between factors such as education levels, share of black population, and foreign born population and the laws, but her analysis also suggests that endogeneity is not a significant concern when studying the effects on educational attainment.

Table 2 shows the developments in the child labor and schooling age requirements for 1910, 1920 and

1930, corresponding to the census years used in the majority of the analysis. When these age requirements were coded as zero, it is assumed that there is no required minimum working age, or schooling age. Across the years, the most common minimum working age was 14. In 1910, 8 states did not have a minimum working age law, but by 1930 all states had such a law. Length of schooling requirements are not shown in the Table, but in 1910, the data on the schooling requirements for work were missing for 8 states, 18 states only required children to be able to read and write and 19 had no minimum length of schooling requirements. Such requirements became more common in 1920 and 1930, ranging between 4 and 8 years of schooling.

Child labor and schooling laws were often introduced prior to a birth registration law. For example, in 1900, 32 states had a legal school leaving age, but only 11 had enacted a birth registration law. In 1910, 30 states had enacted a birth registration law, 40 states had a minimum working age law and 41 states had a legal school leaving age.

3. Hypotheses: Birth registration and age requirements

The core hypotheses tested in this study are that birth certificates facilitated the enforcement of child labor and schooling laws and thus reduced under-aged employment, and raised the school attendance of school aged children. Below, the hypotheses are discussed separately for both child labor and schooling laws. Support from historical documents, in particular for child labor, is also provided. For several reasons, the analysis focuses more on the minimum working age legislation and child labor as the outcome of interest. The results indicate that the minimum working age was the binding constraint for

Table 2

Minimum working age and compulsory schooling age across 48 states between 1910 and 1930, number of states.

Age	Minimum working age			School leaving age			Age	School entry age		
	1910	1920	1930	1910	1920	1930		1910	1920	1930
No age	8	2		7			No age	7		
12	7	4		2	1		6			2
13		1					7	16	21	29
14	33	36	41	18	8	5	8	24	26	17
15		4	5	4	4	1	9	1	1	
16		1	2	15	32	31				
17				1	2	6				
18				1	1	5				

Data source: Goldin and Katz (2011).

work and schooling decisions. The data source used does not capture regular school attendance well, and historical documents tend to focus more on the relevance of birth certificates for the enforcement of minimum working age laws than of schooling laws. School attendance and educational attainment are studied as outcomes mainly for an understanding of potential welfare effects, as child labor does not necessarily imply reduced educational attainment. Given that birth certificates are only directly relevant for the verification of age requirements, the discussion focuses on the legal age requirements rather than requirements to complete a certain number of years of schooling.

3.1. Minimum working age and birth registration

The enforcement of minimum working age legislation took place through the issuance of work permits and inspections of work premises. In 1907, according to Goldmark (1907), 17 states required documentary proof of age for issuing a work permit, 17 states required no proof of age and 14 accepted an affidavit by a parent regarding the age. When documentary evidence was required, birth certificates generally had priority, but if a birth certificate was unavailable, a baptismal record, or a school (graduation) certificate, was generally demanded. That failing, a physical examination may have been carried out to establish age.

According to Shapiro (1950), p. 92, especially during post World War I, “the birth record in some places became the primary document for verifying age in entering school and in obtaining work permits”. In New York state, birth certificates were used in the early 20th century as the primary proof of age for the purpose of granting work permits. In 1909, 75% of the 30,000 employment certificates in New York City were based on birth certificates as the proof of age (Minor, 1910). If a birth certificate could not be presented, the applicant

was formally asked to convince the officers that the birth had not been recorded. In Wisconsin, already in 1903, laws listed birth certificates as the primary form of proof of age required for obtaining a work permit (McLogan, 1935). Lindenmeyer (1997), p. 120–121 discusses how the lack of birth certificates was identified by the Children’s Bureau as an obstacle to the enforcement of the unsuccessful federal child labor law between 1916 and 1918.¹⁸ Clopper (1918) describes similar problems in Alabama. The relevance of birth certificates as proof of age in the early 20th century U.S. has also recently been noted by Landrum (2009, 2011).

These examples suggest that for minimum age laws to be effective, birth registration should be functioning at the state level, and copies of certificates should be accessible, preferably in a uniform format. This was unlikely without state laws on compulsory registration and can explain why states did not require documentary proof of age if there was no state registration law. Out of the 17 states that Goldmark (1907) lists as requiring documentary proof of age for working papers, 13 had passed a state-level birth registration law by 1907. Out of the 31 states that required no proof, or accepted a parent’s affidavit, only 7 had passed a birth registration law by 1907.

If children had generally been born with a birth registration law in place in a specific state, those seeking

¹⁸ This refers to the Keyting–Owen Act, which was an attempt at a federal child labor law made in September 1916. It was declared unconstitutional shortly after (June 1918), and was in practice effective for less than a year (see e.g. Lindenmeyer, 1997, p. 91 and p. 121). Lindenmeyer mentions five states as examples of those where very few children seeking work permits had birth certificates around 1916 (North Carolina: 0.2%, South Carolina: 0.3%, Georgia: 1.4%, Mississippi: 1.8% and Virginia: 6%). These states enacted state birth registration laws between 1912 and 1918, but children nearing working age had been born before this period.

a work permit would be expected to present a birth certificate as proof of age in this state. Claims that a birth was not registered could be verified in the presence of a central repository of certificates. Officials could deny work permits from the under-aged and employers might not be willing to hire under-aged children as inspectors could demand birth certificates. Official proof of age should prove most useful in borderline situations, such as for 12–13 year olds in a state with a minimum working age of 14. Under-aged status would be less disputable for younger children (such as 8–10 year olds). Proof of age was generally required up to a certain age (see e.g. Goldmark, 1907). Thus, if the child appeared to have physically reached such an age, birth certificates might cease to be relevant.

If an individual had been born before a birth registration law, because their state of birth did not have such a law at the time of birth, alternative proof of age (such as affidavits and other documents with potential for falsification) would be relied upon, or the state might not require proof of age. In both cases, children visibly below the working age might be denied work. However, the under-aged closer to the working age might be allowed to work if they presented false proof of age, or were physically mistaken as work-eligible.

How about work-eligible children? If children had reached the minimum working age, they would either be able to prove with a birth certificate that they are eligible, or in the absence of having had their births registered, would fall in the borderline category and be likely to be granted permits. In a strict enforcement environment, where only birth certificates were accepted as proof of age, it is possible that some work-eligible children would be denied a work permit if they could not produce a birth certificate. However, if work-eligible children could prove that their birth was not registered alternative proof may have been accepted.

To conclude, birth registration could be expected to reduce under-aged employment, but not necessarily affect the employment of work-eligible children directly, or do so to a considerably smaller degree. If the lack of birth certificates denied work from the work-eligible, those born with a registration law would be more likely to work than those born without, controlling for other factors.

3.2. *Compulsory schooling age and birth registration*

In relation to compulsory schooling laws, reliable proof of age should identify school-aged children more accurately, both at the school entry stage, but also later in the detection of truants. Drawing on the historical

experiences of today's industrial countries (Germany, Japan, UK, USA), [Fyfe \(2009\)](#) suggests that it was easier to enforce school attendance laws with “good data, including school registers and birth registration”. In their study on the connection between secondary schooling and child labor and compulsory schooling laws, [Goldin and Katz \(2011\)](#) note that “changes in enforcement, not changes in the laws, may have mattered, and we (as well as the others mentioned) have not yet secured a variable that captures enforcement expenditures and efforts for all states during the period of interest.” Birth registration could be considered a relevant enforcement dimension.

If schools could demand birth certificates to ascertain a child's age at the school entry stage, children would be more likely to enter school at the required age. Those having reached this age might be less likely to ignore the law, if they would be expected to present official proof of age. Closer to school leaving age, truancy officers and schools could be expected to identify under-aged truants better with birth certificates. If birth registration supported school censuses in identifying accurately school-aged children, this could have had implications for educational planning and school investments. Then, we might see a connection between birth registration and schooling, independent of compulsory schooling and child labor laws.

In general, attendance rates could be expected to be higher for school-aged children born with than without birth registration laws. It might also be possible that due to the lack of birth certificates, children entered school too early, or were not allowed to leave once they had reached the legal leaving age. In these cases, children outside the compulsory schooling age range would be less likely to be in school when they were born with than without a birth registration law, controlling for other factors.

4. Birth registration laws and child labor: Data and model specification

The next two [Sections 4 and 5](#) focus on the connection between birth registration laws and minimum working age laws with child labor as the outcome of interest. This Section describes the individual level data and the core variables and the econometric model. [Section 5](#) reports the results.

4.1. *Data and core variables*

The analysis relies on the census samples for 1910, 1920 and 1930. There are several justifications for

choosing these samples. The census of 1910 is the first census to be used because data on child labor laws are available from 1910 (from Goldin and Katz, 2011). While some states had enacted birth registration laws prior to 1900, the difference between the share of 6–18 year olds born with a registration law in place changed rather little between 1900 and 1910 (from an average of 0.21 to 0.25), but increased significantly between 1910 and 1930. As will be seen in the figures below, the share of children who reported an occupation declined significantly between 1910 and 1930, in particular between 1910 and 1920. There are also methodological justifications for using several censuses, which will be discussed below in conjunction with the econometric model. The census for 1940 is no longer used, as by this point in time, the share of children with an occupation was small and all children in the age group studied would have been born with a birth registration law in place.¹⁹

Whether a child was born before, or after a birth registration law, is determined on the basis of the child's year of birth and state of birth. The “*registration law*” variable used in the analysis is a dummy variable that takes a value of one if the child was born during, or after the year of the registration law, and a zero otherwise. The month in which the registration law became effective

cannot be determined for all states from the sources used. Additionally, the censuses for 1910–1930 only include the child's age, but not the year, or month of birth. Therefore, age is used to calculate the year of birth. This introduces some unavoidable imprecision. The information on age in the census refers to age on the following days: 15 April, 1 January and 1 April for 1910, 1920 and 1930 respectively. Given that the reference point is early in the calendar year, the year of birth is defined as “census year – age – 1”. In a robustness check, it is defined as “census year – age”.

The analysis is restricted to children born in one of the 48 U.S. states, given that the state of birth is used to determine whether the child was born with a birth registration law in place.

Similar to previous studies on child labor, such as Moehling (1999) and Manacorda (2006), the employment status of children is based on whether the child reports an occupation or not. To determine occupational status, occupational coding for the particular census year is used.²⁰ Precise occupational codes are not comparable between 1910–20 and 1930. However, the codes can be used for the purpose of identifying whether the child has an occupation. Everyone with an occupation code is assumed to be working, while those with “no occupation reported” are assumed not to be working. The study uses the expressions ‘child reports an occupation’ and ‘child works’ interchangeably.²¹

The ‘*child labor law*’ variable used in the regression analysis is a dummy variable that takes a value of 1 when the child's age is below the minimum working age, and 0 otherwise. The minimum working age is the

¹⁹ Work of children and women was also treated more explicitly in the 1910 than in the 1900 Census (see e.g. Moehling, 2004 for a discussion on the improvements in the 1910 census as opposed to the 1900 Census). This was also the case for the censuses for 1920 and 1930. The 1900 census was suspected of under-counting working children. It is possible that the 1910 census in turn somewhat over-counted working children in relation to the censuses for 1920 and 1930. These concerns relate mainly to farm labor. Regarding children working on farms, the instructions for the enumerators of the 1900 census, which included occupation for children aged 10 and above, were somewhat vague: “Enter the older children of a farmer (who works on the farm) as farm laborers, except when a father and son (or sons) jointly operate the farm for fixed shares of the product”. The instructions for the censuses for the following years included a more explicit section on children working on farms, and the treatment remained broadly similar between 1910 and 1930. The 1910 census instructions read: “In the case of children who work for their own parents on a farm, the entry in column 18 should be farm laborer and in column 19 home farm; but for children who work as farm laborers for others, the entry in column 19 should be working out.” However, for the 1920 and 1930 Censuses the word “regularly” (for work) is included, which might imply that the 1910 Census could overestimate working children somewhat in relation to the 1920 Census. Seasonality has been raised as another potential concern; the 1910 census was conducted in April and the 1920 census in January, which could affect the prevalence of reported agricultural employment by children (see e.g. Horowitz, 1928). The 1930 census was conducted again in April. Both the 1910 and 1920 censuses have been used in previous studies on child labor.

²⁰ 1920 codes are used for 1910 and 1920 and 1930 codes for 1930. In 1910–1930, occupation was reported also by persons who were temporarily unemployed. Those with a blank or missing code are classified as not working. Those with an illegible, or inconsistent code, are excluded. Codes used in the census year are considered to reflect occupation more precisely at the relevant point in time than occupation based on the 1950 classification, which is the other available alternative. There are a small number of cases who have been classified as not having an occupation code with the current classification, but having one with the 1950's classification. It should be noted that the choice of dependent variable would not affect the results of the analysis.

²¹ In 1910 and 1930, a separate variable is available for whether the child is employed, unemployed or not in the labor force. However, it is not available for 1920, and therefore cannot be used. The variables on employment and reporting an occupation in 1910 and 1930 overlap to a large extent. Of the 12–15 year olds in the regression sample, those classified as outside the labor force, do not report an occupation in either 1910 or 1930. An occupation is available for a majority of those who are classified as employed. A small share of the 12–15 years olds classified as employed, does not report an occupation (5% in 1910 and 2% in 1930).

“Age at which youth can obtain a work permit for work during normal school hours” in the child’s state of residence in each census year (Goldin and Katz, 2011). The ‘school law’ variable is a dummy variable that takes a value of 1 when the child has reached the minimum school entry age, but is below the minimum school leaving age. This relies on the following indicators in Goldin and Katz: ‘Minimum required school entrance age’ and ‘Maximum compulsory schooling age’ (school leaving age). If there are no age requirements, the dummy variables take a value of 0.

The analysis focuses on children between the ages of 12–15. This is the age range for which there is most variation in the combination of the core variables: dummy variables for the minimum working age law (‘child labor law’) and the registration law. The first panel in Table 3 illustrates this by cross-tabulating the two variables for the following age groups: 6–11, 12–15 and 16–18 for a pooled sample for 1910–1930. There are few 6–11 year olds to whom a minimum working age law does not apply (4%) and there are no 16–18 year olds below the minimum working age. Therefore, due to the lack of variation in the

combinations of the child labor and registration law variables, it is not meaningful to estimate the relevance of registration laws for the enforcement of the minimum working age for 6–11 or 16–18 year olds. Additionally, the share of children working in the age group of 6–11 is low (between 1 and 4% in different censuses), whereas the share of 12–15 year olds working in the regression sample varies between 6 and 23% for different censuses. The second panel of Table 3 includes a cross-tabulation of the compulsory schooling law dummy and the registration law dummy, to be discussed further below. There is more variation in the combinations of these laws for 6–11 year olds.

Table 4 reports summary statistics for the variables used in the regression analysis separately for each census year. The figures show how the share of children born with a registration law in place increased from 23% in 1910 to 89% in 1930. They also show a significant decline in child labor over the period studied, in particular between 1910 and 1920. Child labor was more prevalent in rural than in urban areas.

Fig. 2 below provides initial support for a connection between birth registration laws and the effectiveness of child labor laws, although state, or cohort-specific factors are not yet controlled for. It presents the employment rates of children in each census year, for two types of states of birth; those where all children that had been born with a birth registration law in place and those where all children that had been born prior to the enactment of the registration law. It covers only children in states with a minimum working age. The horizontal axis is the child’s age minus the minimum working age in the child’s state of residence. In the census years, the lowest minimum working age was 12 and the highest 16. The maximum age range covered in the graphs is 9–18 years. The graphs illustrate that under-aged children (–3 to –1), born with a registration law in place, were less likely to be employed than under-aged children born before the registration law was enacted. In 1910 and 1920, the difference in the employment shares of those born with and those born without a registration law narrows down once children reach the minimum working age (0–2). In 1930, the employment rate of children born before a registration law is constantly lower than the rate of those born after. However, there are only three states of birth where no one in the age group had been born before a registration law.

4.2. Identification and estimation

The analysis relies on a pooled sample for the three census years, although results of core specifications are

Table 3
Cross-tabulation of laws across age groups and census samples (shares of children).

1910–1930			1910–1930		
Age: 6–11, N = 383,340			Age: 6–11, N = 383,340		
	Registration law			Registration law	
Child labor law	0	1	School law	0	1
0	0.04	0.003	0	0.13	0.17
1	0.30	0.65	1	0.21	0.49
Age: 12–15, N = 240,081			Age: 12–15, N = 240,081		
	Registration law			Registration law	
Child labor law	0	1	School law	0	1
0	0.30	0.22	0	0.14	0.04
1	0.18	0.30	1	0.32	0.50
Age: 16–18, N = 172,066			Age: 16–18, N = 172,066		
	Registration law			Registration law	
Child labor law	0	1	School law	0	1
0	0.59	0.41	0	0.56	0.41
1	0	0	1	0.01	0.02

Child labor law = Dummy variable that takes a value of 1 when child is below minimum working age. Registration law = Dummy variable that takes a value of 1 when the child was born during, or after, the year of the birth registration law. School law = Dummy variable that takes a value of 1 when the child has reached the minimum school entry age and is below the minimum legal school leaving age. Sample includes all US-born children residing in 48 U.S. states.

also shown separately for each census sample. The full Logit model specification with the pooled sample takes the form

$$\text{Prob}(W_i = 1) = F\left(\alpha_0 + \alpha_1 R_{bc} + \alpha_2 C_{say} + \alpha_3 R_{bc} C_{say} + Z_i' \beta + \delta_c + \gamma_b + \psi_s + \varepsilon_i\right) \quad (1)$$

where i refers to individual, b to state of birth, s to state of residence, c to birth cohort, a to age and y to census year. F is a logistic function. The dependent variable, W_i refers to whether, or not, the child reports an occupation, which is used as the indicator for whether the child works or not. R_{bc} refers to a dummy variable, which takes a value of 1 if the child is born after or during the year when the birth registration law was enacted. R_{bc} varies between birth states and between cohorts within a state. Children born in one state may have a different registration status depending on their year of birth. C_{say} refers to a dummy variable for

whether the child is too young to obtain a work permit (value 1). For a specific census year, C_{say} varies between states of residence and between age groups within states of residence. In the pooled sample it also varies by census year, as minimum age laws changed over time. $R_{bc} C_{say}$ is an interaction term between the dummy variables for the minimum working age and the registration law. The interpretation of the interaction term is discussed separately below. Z_i refers to a vector of control variables (in core models dummies for gender and race). Standard errors in all models are clustered at the state of birth \times cohort level, as this is the level at which the registration laws are defined.

The coefficient sets γ_b and ψ_s refer to sets of dummy variables for the child's state of birth and state of residence respectively. Both types of state dummies are

Table 4
Summary statistics, means, children 12–15 years.

Core variables	1910	1920	1930
Male *	0.51	0.50	0.50
Black *	0.136	0.121	0.105
Other non-white *	0.004	0.003	0.005
Registration law *	0.23	0.39	0.89
Child labor law *	0.35	0.49	0.57
School law *	0.62	0.87	0.92
Child works (reports occupation) *	0.23	0.11	0.06
Child works (urban)	0.13	0.09	0.03
Child works (rural)	0.28	0.13	0.09
Works & born with registration law	0.11	0.07	0.10
Works and born without registration law	0.26	0.14	0.06
Obs.	69,276	77,469	91,108
<i>Additional household/individual controls</i>			
Both parents foreign *	0.17	0.17	0.18
No mother *	0.10	0.09	0.08
No father *	0.16	0.14	0.14
Head literate *	0.88	0.90	0.92
Occupational score of head	19.88	20.64	21.68
Head works in agriculture *	0.42	0.38	0.31
Age of head	46.2	46.02	45.59
Female head *	0.10	0.09	0.09
Number of individuals in household	6.74	6.61	6.37
Urban *	0.37	0.41	0.48
<i>State level controls (different years) ¹</i>			
Education expenditure/pupil (\$1913)	16.72	19.75	28.41
Voter turnout (%)	76.38	62.39	59.33
Unemployment share	0.05	0.06	0.07
Share literate	0.86	0.90	0.92
Share foreign born	0.12	0.13	0.12
Obs.	68,917	76,991	90,455

Notes to Table 4:

'Child labor law' = Dummy variable for whether child is below minimum working age. 'Registration law' = Dummy variable for whether the child was born during, or after, the year of the birth registration law. 'School law' = Dummy variable for whether the child has reached school entry age and is below maximum school leaving age. 'Other non-white' includes all ethnicities other than black and white. The racial categories are based on the "Race" variable. Blacks include negros and mulattos. 'Both parents foreign' refers to a case where the child is native born, but both parents are foreign-born. No mother/no father indicates that no link to a mother/father-figure (related or unrelated) is identified in the data. 'Head literate' refers to whether the household head can both read and write. 'Number of individuals in household' excludes outlier values above 15. 'Occupational score' is available for individuals who have an occupation and takes a value up to 80. A person's occupation is assigned a value that represents the median total income of all individuals with that occupation in 1950 (in hundreds of 1950 dollars). It includes values of zero for those without an occupation (the regression models control for this with a 'missing dummy'). 'Head works in agriculture' is a dummy variable based on the industry of employment (1950 classification) and covers agriculture, forestry and fishing. The urban area consists mostly of households in cities and incorporated places with 2500+ inhabitants.

¹ State level controls are the following: public school education expenditure/number of enrolled students in each state of birth in the child's year of birth (source: Bureau of Statistics, 1880, 1899, 1909/10) deflated by the "general price index" with 1913 as the base year (source: U.S. Bureau of the Census, 1949), voter turnout in U.S. presidential elections (refers to year 1896 for those born in 1894–97, year 1908 for those born in 1904–07 and year 1916 for those born in 1914–17) in each state of birth around the time of birth (source: McIver, 2006), share of 18–60 year old men in the labor force in each state of residence for 1910, 1920 and 1930 (source: the census), the share of literate above 15 year olds and the share of foreign born individuals (of all age) in each state for 1900, 1910 and 1920 for those born in years 1894–97, 1904–07, 1914–17 respectively (source: the census).

* Refers to a dummy variable. Sample is the one in the regression models in Table 5, and includes U.S. born children in 48 states, excluding Alaska, District of Columbia and Hawaii. Institutional inmates are excluded.

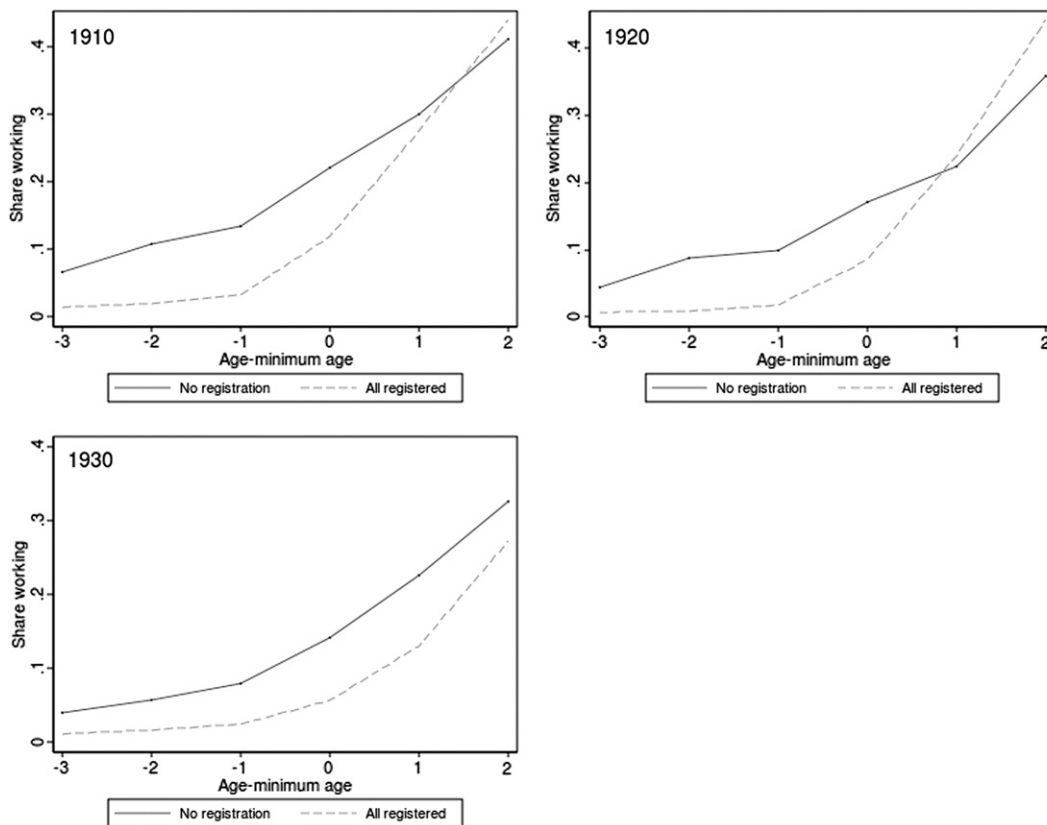


Fig. 2. Share of working children below and above the minimum working age in two groups of birth states. Maximum age range: 9–18. Includes only states with a minimum working age law. ‘No registration’: states where no one in the relevant age range had been born with a birth registration law in place. ‘All registered’: states where everyone in the age range had been born on, or after a birth registration law was enacted. ‘Age–minimum age’ refers to the age of the child minus the minimum legal working age.

controlled for as some of the children do not reside in their state of birth (14%).²² The coefficient set δ_c refers to a set of dummy variables for birth cohorts.²³

The inclusion of state effects in the models guarantees that the identification of the legal effects is not compromised by state-specific unobservable variables that are fixed over time. Birth year dummies control for factors common to a specific birth year. Therefore, the identification of legal effects relies on the remaining variation in the registration law and child labor law, after state of birth, state of residence and cohort effects have been controlled for. Technically, the variation in the legal variables comes from the interaction between the state effects and the cohort effects. For the specification to

be meaningful there should be enough within variation in the legal variables both within cohorts and within states.

As discussed above, there are several justifications for limiting the sample to 12–15 year olds. However, in each separate census, in the sample of 12–15 year olds, the registration law variable would vary by cohort, but not much by state of birth. In the 1910 census, for 12–15 year olds, there is variation in the registration law dummy only in one state of birth. In other states, all 12–15 year olds are either born with, or without the registration law. The number of states with variation rises to 7 out of 48 in 1920, and falls to 4 in 1930. By pooling the census samples for three years together (1910–1930), a broader range of birth cohorts is included. This significantly increases the variation in the legal variables and their combinations and allows for the controlling of state of birth effects. There is variation in the registration law dummy now in 35 states of birth (71% of sample). Therefore, most of the analysis relies on the pooled sample.

²² The results would remain robust to the exclusion of movers.

²³ Age dummies and census year dummies would be redundant, as they are controlled for by the cohort effects.

In the above framework, the identifying assumption is that the timing of the laws does not correlate with unobservable state-specific factors that vary over time and affect child employment. As the discussion in [Section 2](#) indicates, increases over time in factors such as the degree of urbanization, investments in public services, the quality of the legal system or general concern over child protection may have contributed to the enactment of the registration laws. If registration laws enhanced the enforcement of child labor laws, a negative bias in this estimated effect (i.e. overestimation of the impact) is possible if increases in such factors determined both the timing of the registration laws and contributed to a fall in child employment for the corresponding birth cohorts (12–15 years later). To mitigate such concerns, the pooled models control for linear cohort trends for each state of birth, and in robustness checks sets of time-varying variables at the level of states, households and individuals are controlled for. Among the control variables are for instance urban residence, literacy and state expenditure in education. However, evidently all possible sources of bias cannot be completely ruled out.

On the other hand, the effect of full birth registration coverage can also be underestimated, given that full coverage was not achieved immediately by the registration laws. This study focuses on the effects of the laws, and this is a common feature of econometric studies on laws when enforcement is imperfect. In the absence of accurate estimates of the registration coverage, the degree of underestimation cannot be specified.

4.3. Interpretation of the coefficients

The interpretation of the coefficients for the legal variables in model (1) merits some discussion. Theoretically, birth registration laws could have the following effects:

- a) Similar effect on under-aged and work-eligible children:

$$\alpha_1 \neq 0, \alpha_3 = 0$$

- b) Effect only on under-aged children:

$$\alpha_1 = 0, \alpha_3 \neq 0$$

- c) Effect only on work-eligible children:

$$\alpha_1 \neq 0, \alpha_1 + \alpha_3 = 0$$

- d) Effects on both, but differentially:

General case: $\alpha_1 \neq 0$ and $\alpha_3 \neq 0$ and $\alpha_1 + \alpha_3 \neq 0$

Opposite effects:

i) $\alpha_1 > 0$ and $\alpha_1 + \alpha_3 < 0$

ii) $\alpha_1 < 0$ and $\alpha_1 + \alpha_3 > 0$

The expected effect based on the hypotheses discussed in [Section 3](#) is b) with $\alpha_3 < 0$. However, d.i) is also a possibility if birth registration laws increase the likelihood that the under-aged are denied work permits, but also facilitate the granting of work permits to the work-eligible. a) Would seem a more plausible hypothesis if registration affected employment through some other mechanism than the granting of work permits. Hypotheses c) and d.ii) appear unlikely, or counter-intuitive.

The α_2 coefficient in model (1) reflects the effect of the minimum working age legislation on the likelihood of employment of under-aged relative to work-eligible children, for children born before a registration law. The coefficient α_3 captures the additional effect of the minimum age law on the under-aged when they have been born with a birth registration law.²⁴

Given that most of the explanatory variables are dummy variables, it is logical to estimate average marginal effects rather than marginal effects at the means. It is important to note that in the case of the interaction term, the average marginal effect ($\Delta^2 F(\cdot) / \Delta R_{bc} \Delta C_{say}$) and its standard error have to be calculated using the delta method (see [Norton et al., 2004](#) for details). Marginal effects in non-linear models are conditional on the values of the independent variables and this also applies to the marginal effects of interaction terms (see [Norton et al., 2004](#)). The results section includes graphs that show how

²⁴ It should be noted that the difference in the employment of under-aged and work-eligible may not be driven simply by effects on the under-aged. A reduction in under-aged employment may change the demand for work-eligible children, for instance if the two are close substitutes. For a general theoretical contribution on how the welfare effects of bans on child labor depend on labor market effects, see e.g. [Basu and Van \(2005\)](#), which discusses the distinction between adult and child labor. [Bugni \(2012\)](#) suggests that a difference in differences approach may underestimate the effects of child labor laws on under-aged employment if the resulting increase in adult labor leads to a decline also in the employment of work-eligible children. If a reduction in the employment of the under-aged due to the minimum working age law would generate a demand effect on the work-eligible, this would be reflected in the coefficients α_2 and α_3 . If birth registration laws improve enforcement and reduce under-aged employment further, any demand effect on the work-eligible could be expected to be magnified with birth registration laws. However, it is reasonable to assume that the ratio, α_3/α_2 , which measures the relative improvement in legal enforcement due to birth registration laws, remains unaffected by any labor market effects on the work-eligible.

the marginal effects of key variables of interest vary depending on the values of explanatory variables.

5. Birth registration laws and child labor: Results

5.1. Results of basic models

The first column (1) in Table 5 relates to a specification that includes the dummy variables for the registration law and the child labor law, but excludes the interaction term between the two. The coefficient for the birth registration law dummy is statistically insignificant, which would imply that the registration law did not have a common, independent effect on the likelihood of employment of all children. Children below the minimum working age were 5 percentage points less likely to work than work-eligible children. This coefficient is similar in magnitude to that in Manacorda (2006). The study by Moehling (1999) focuses on an earlier time period with a narrower age range and a different estimation strategy. However, the magnitude of the estimated coefficient here is similar to an estimate in her study for boys between 1900–1910 (–6 percentage points), although her estimate was not statistically significant.

The next step is to evaluate whether birth registration laws altered the effect of the minimum age law. In

column (2), the model includes the interaction term between the two legal dummies. The coefficients for both the child labor law variable and the interaction term are statistically significantly negative. The coefficient for the registration law alone remains statistically insignificant. The results indicate that when born before the registration law, children below the minimum age were 3.4 percentage points less likely to work than work-eligible children. However, when born with a birth registration law in place, those below the minimum age, were 9 percentage points less likely to work than the work-eligible. This result supports hypothesis b) above with $\alpha_3 < 0$; that the birth registration law reduced the likelihood of employment of legally under-aged children relative to the work-eligible.

To control for unobservable state-specific linear trends in child employment, model (3) includes year of birth trends for each state of birth. The results change little.

Columns (4) to (6) present the results of census-specific models. This is done primarily for an indication of the potential differences in the effects of interest across census years. State of residence dummies are included, but state of birth dummies are excluded in these specifications, given the limited within state of birth variation in the registration law dummy for 12–15 year olds in each census separately. However, dummies for

Table 5
Dependent variable: Likelihood that child reports an occupation.

Logit models							
	Pooled 1910–30			1910	1920	1930	Pooled 1920–30
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Registration law	–.005 [.009]	.013 [.010]	.007 [.015]	.027 [.023]	.020 [.011]	.004 [.005]	–.030 [.016]
Child labor law	–.049 [.007]**	–.034 [.008]**	–.037 [.008]**	–.074 [.016]**	–.032 [.010]**	.003 [.008]	–.018 [.009]
Child labor law × Registration law		–.053 [.012]**	–.050 [.014]**	–.113 [.027]**	–.080 [.014]**	–.004 [.006]	–.026 [.010]**
Male	.091 [.002]**	.091 [.003]**	.091 [.002]**	.159 [.006]**	.080 [.003]**	.048 [.003]**	.063 [.002]**
Black	.079 [.003]**	.078 [.003]**	.078 [.003]**	.122 [.007]**	.073 [.005]**	.050 [.003]**	.061 [.003]**
Other non-white	.003 [.015]	.004 [.015]	.002 [.015]	–.038 [.028]	–.024 [.023]	.044 [.020]*	.022 [.017]
Obs.	237,853	237,853	237,853	69,276	77,469	91,065	168,577
State of birth trends			Yes	Yes	Yes	Yes	Yes
Census division dummies							
Log-likelihood	–69,449	–69,290	–69,172	–29,043	–22,643	–17,042	–39,645

Notes: **, * significant at the 1 and 5% levels respectively. Reported coefficients are average marginal effects. The sample includes US-born individuals aged 12–15. Models (1)–(3) and (7) include dummy variables for year of birth, state of birth and state of residence. Models (4)–(6) include cohort dummies, state of residence dummies and dummies for 10 U.S. census divisions of birth. Standard errors (in brackets) are clustered at state of birth × cohort level. A Wald test is used to test for statistical significance. Due to multicollinearity, the 1930 estimation (6) drops individuals residing in Nevada (43 observations).

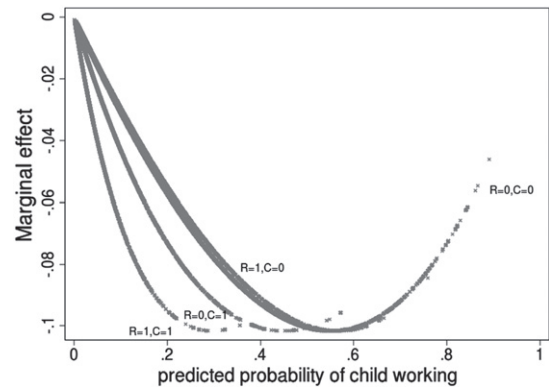
each of the nine U.S. census divisions²⁵ of birth are included. Nevertheless, the interpretation of the results requires caution, given that state of birth specific factors that might correlate with the enactment of the registration laws, are not controlled for.

Starting with 1910, the results in the first column show that under-aged children born before the registration law were around 7 percentage points less likely to work than work-eligible children. However, under-aged children born with a registration law in place were around 19 percentage points less likely to work than work-eligible children. The models for 1920 broadly support the conclusions for 1910, although the effects are smaller. Under-aged children born before the registration law were 3.2 percentage points less likely to work than work-eligible children, whereas under-aged children born with a registration law were 11 percentage points less likely to work than the work-eligible.

By 1930 children below the minimum working age were no longer less likely to work than work-eligible children. Neither the birth registration law nor its interaction term with the child labor law dummy, are statistically significant. By this time, the incidence of child labor had fallen to low levels and 89% of children had been born with a birth registration law in place.

The results for the pooled models and for 1910 and 1920 indicate that the birth registration law more than doubled the effectiveness of the minimum working age legislation in reducing under-aged employment. It did not have a statistically significant independent effect on the employment of work-eligible children. The interaction effect is larger in the census-specific models for 1910 and 1920 than in the pooled models. This indicates that the inclusion of the 1930 sample in the pooled models weakens the overall effect. However, the coefficients for the census-specific models may also be biased due to the exclusion of state of birth effects.

As mentioned in footnote 19, the 1910 census possibly over-counted children with an occupation, mainly those involved in farm labor. Cohort dummies in the models partly address this, but among the additional specifications in the next section, separate models are estimated for children in agricultural areas and in non-agricultural areas. The last column in Table 5 also shows the results of a specification with a pooled sample only for 1920 and 1930. While the coefficient for the child labor law dummy is not statistically significant at the 5% level, the



Notes: The estimated model corresponds to that in column (3) of Table 5. R = registration law, C = child labor law

Fig. 3. Distribution of marginal effects for 'child labor law' across predicted probability of employment. Notes: The estimated model corresponds to that in column (3) of Table 5. R = registration law, C = child labor law.

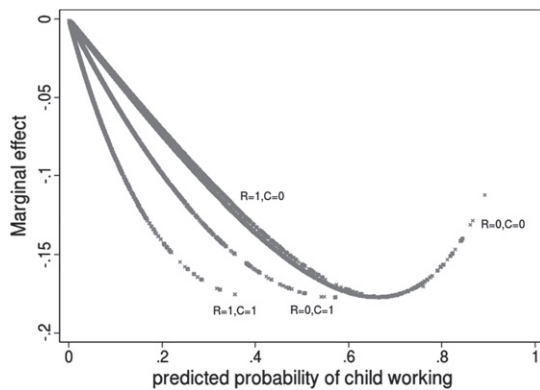
coefficient for the interaction term remains significantly negative, although not as large as in the pooled models for 1910–1930.

In Logit models, the marginal effects for specific variables, including the interaction term will vary depending on the values of the other explanatory variables. The estimates in Table 5 are average marginal effects. Figs. 3 and 4 show the distribution of the marginal effects for the child labor law dummy and the interaction term with the registration law dummy across all predicted values of the likelihood of employment. Each observation is plotted. The model specification is the one in column (3) of Table 5.²⁶ This exercise has two objectives; to observe whether the signs of the legal effects vary across predicted values and to show the distribution of the effects from which the average effects are calculated. Norton et al. (2004) illustrate that the marginal effect for the interaction term can change sign depending on the values of the explanatory variables. Therefore, it is noteworthy that both effects have a negative sign for all predicted values. The marginal effect for the registration law dummy alone is always positive, but not shown as it remains small.

The average marginal effect is not driven significantly by large negative effects for specific groups, or

²⁵ These include New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific.

²⁶ The marginal effects appear as four separate 'curves' due to the way in which they and the predicted values are defined. The variables R, C and $R \times C$ enter into the equation for the predicted value, but not the difference equations for the marginal effects. The four separate curves relate to the four possible combinations of the values for R, C and $R \times C$.



Notes: The estimated model corresponds to that in column (3) of Table 5.
R = registration law C = child labor law

Fig. 4. Distribution of marginal effects for ‘child labor law \times registration law’ across predicted probability of employment. Notes: The estimated model corresponds to that in column (3) of Table 5. R = registration law, C = child labor law.

observations. For the majority of observations, the values of the marginal effects remain within a fairly moderate range; 75% of the effects for the interaction term are between 0 and -0.071 and 75% of the effects for the child labor law dummy are between 0 and -0.055 . The marginal effects do tend to be larger for those subsamples with a higher rate of child employment. Thus, they are larger for boys than girls,²⁷ larger for earlier cohorts and larger for states in the Southern census region than in the other three census regions (Northeast, West and Midwest). However, these differential marginal effects, including the shape of the scatter plots, represent partly a technical feature of the Logit model (see Norton et al., 2004). Sub-sample estimations for different groups would not necessarily lead to similar conclusions. To estimate how the effects of the legal variables vary by specific groups, models should be estimated separately for such groups. Such results are discussed below as part of the discussion on additional specifications.

Overall, the results indicate that the minimum working age legislation reduced the likelihood of under-aged employment and birth registration laws made the minimum working age law more effective in reducing under-aged employment, particularly in 1910 and 1920. The results do not lend support for hypothesis d.i); that registration laws may have directly facilitated the employment of the work-eligible.

²⁷ Among U.S. born 12–15 year olds, the share of boys employed was 30% in 1910, 15% in 1920 and 9% in 1930, whereas that of girls was 14% in 1910, 7% in 1920 and 4% in 1930.

5.2. Additional specifications and robustness checks

5.2.1. Inclusion of control variables

The first column in Table 6 shows the results of a pooled model that in addition to all the controls in the model in column (3) of Table 5 includes a set of individual and household specific variables separately for each census. The variables are listed in the notes to the table and the summary statistics are shown in Table 4. The inclusion of these variables leads to little change in the coefficients for the legal variables, and the conclusions from the previous section hold.

In the next column, in addition to the set of individual and household variables, a set of state-specific variables is included. The variables are chosen to represent investments in education and the levels of awareness, immigration and political engagement that may have correlated with the timing of the registration laws and levels of child labor later on. The specific variables are public education expenditure per pupil in each state of birth at the time of birth for each birth cohort, adult literacy and the share of foreign born individuals in each state of birth in 1900, 1910 and 1920. Additionally, voter turnout in presidential elections in each state of birth for a year close to the birth year (1896, 1908, 1916) and the share of unemployed adult men in the state of residence in the current census year, are included. The last one is included mainly to control for a possible correlation between child labor laws and current unemployment rates. The precise definitions and data sources for these variables can be found in the notes to Table 4. Not all of these variables are statistically significant in the model, and their inclusion does not alter the conclusions on the legal variables, although the coefficients are slightly smaller. These results suggest that trends in these key socioeconomic variables are not driving the results on the registration laws.

Finally, a model that includes a dummy variable for whether the child is within the compulsory schooling age range, as defined in Section 4 (‘school law’), is estimated. The results are shown in column (3) of Table 6. However, neither the schooling law nor its interaction with the registration law, are statistically significantly connected with the likelihood of a child working. This would support the conclusion that the minimum working age rather than the minimum school leaving age was the relevant constraint for employment.

5.2.2. Falsification exercise

Table 6 also reports the results of further tests to analyze whether the estimated effect could be capturing a pre-enactment trend in child employment. In the first

Table 6

Control variables and falsification tests dependent variable: Likelihood that child reports an occupation.

Pooled Logit models								
	Controls			Early implementation				Census shift
	(1)	(2)	(3)	3 years	5 years	7 years	9 years	
Registration law	.008 [.015]	.003 [.011]	.001 [.015]	.027 [.024]	.022 [.032]	.044 [.018]*	.009 [.023]	–.038 [.031]
Child labor law	–.036 [.008]**	–.023 [.007]**	–.035 [.008]**	–.053 [.011]**	–.050 [.011]**	–.048 [.011]**	–.048 [.013]**	–.052 [.013]**
Child labor law × Registration law	–.051 [.013]**	–.041 [.010]*	–.051 [.014]**	–.019 [.024]	–.023 [.023]	–.005 [.016]	–.015 [.019]	.011 [.015]
Edu. expenditure/pupil (\$, 1913 = 100)		.001 [.001]						
Voter turnout (%)		.001 [.001]						
Unemployment share (census year)		–.476 [.300]						
Share literate		–3.315 [.308]**						
Share foreign born		–.467 [.434]						
School law			.007 [.008]					
School law × Registration law			.010 [.012]					
Obs.	236,363	234,341	237,853	110,679	110,679	110,679	110,679	96,029
State of birth trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables ¹	Yes	Yes						
Log-likelihood	–66,178	–64,894	–69,159	–43,250	–43,177	–43,173	–43,173	–38,627
Share born with ‘false’ registration law				0.24	0.27	0.36	0.48	

Notes: **, * significant at the 1 and 5% levels respectively. Reported coefficients are average marginal effects. The sample includes US-born individuals aged 12–15. All models include dummy variables for year of birth, gender, race, state of birth and state of residence. Standard errors (in brackets) are clustered at the state of birth × cohort level. A Wald test is used to test for statistical significance. See Table 4 for variable definitions and data sources.

Columns (4)–(7) refer to a pooled 1910–1930 sample of individuals born before the registration law and it is assumed that the registration law was enacted earlier, by the specified number of years. The last column ‘Census shift’ includes a sample of 12–15 year olds in the 1910–1920 censuses, born in states where all 12–15 year olds were born before the birth registration law. The distribution of the registration law variable comes from the 1920 and 1930 censuses for 1910 and 1920 respectively.

¹ Control variables: dummy variables for both parents foreign, no mother, no father, literate head of household, female head of household, urban location, head is an agricultural worker and variables on the occupational score of the head of household (including missing dummy for those without occupation), the number of individuals in the household and age of head. In addition to these additional control variables, the model in column (2) includes a set of state-specific variables, the coefficients of which are shown in the table. Column (3) refers to the same specification as column (3) in Table 5, but includes additionally a dummy variable for compulsory schooling age and its interaction with the registration law dummy.

test, the sample is restricted to individuals born before the birth registration law was enacted. This guarantees that there are no individuals in the sample who in reality were already affected by the registration law. It is then assumed that the birth registration law in each state in the sample was enacted a specific number of years before the actual enactment year. The main regression specification is then estimated for this sample of the pooled data set for 1910–1930. Table 6 reports the results for 3, 5, 7 and 9 years earlier. Three years is chosen as the starting point in order to guarantee that a sufficient number of individuals are determined falsely

as having been born with a registration law. Unless the registration law dummy captures a “pre-enactment” trend for the cohorts, one would expect an insignificant coefficient for the registration law and the interaction term. This is confirmed, with the exception of the model with implementation 7 years earlier, where the coefficient for the registration law variable alone is statistically significant. This may be a random coincidence.

The last column of Table 6 presents the results of a further falsification test. The sample is first restricted to 12–15 year olds in the 1910 and 1920 censuses, who were born at a time when no one in this age group had

Table 7

Different groups dependent variable: Likelihood that child reports an occupation.

Pooled Logit models						
	White	Black	Non-farm	Farm	Non-agr. counties	Agr. counties
Registration law	.010 [.010]	–.004 [.012]	.013 [.009]	–.009 [.009]	.012 [.008]	.003 [.009]
Child labor law	–.037 [.008]**	–.007 [.012]	–.033 [.006]**	–.021 [.006]**	–.028 [.006]**	–.014 [.006]*
Child labor law × Registration law	–.044 [.010]**	–.018 [.019]	–.031 [.009]**	–.020 [.009]**	–.034 [.008]**	–.020 [.011]
Obs.	208,643	28,240	148,340	89,513	152,823	85,015
State of birth trends			Yes	Yes	Yes	Yes
Log-likelihood	–53,454	–15,118	–31,044	–34,606	–33,266	–34,153

Notes: **, * significant at the 1 and 5% levels respectively. Reported coefficients are average marginal effects. The sample includes US-born individuals aged 12–15. All models include dummy variables for year of birth, gender, state of birth and state of residence. They also include race dummies with the exception of those in columns 1 and 2. Standard errors (in brackets) are clustered at the state of birth × cohort level. A Wald test is used to test for statistical significance.

Columns (1)–(2) do not include state trends as they could not be estimated with such for the black sub-sample.

been born with a registration law in place in their state of birth. A false registration law variable is created by imposing the 1920 distribution of the registration law dummy on the 1910 census, and the 1930 distribution on the 1920 census, on the basis of a child's age and state of birth. Then, a model is estimated with a pooled 1910 and 1920 sample. Unless unobserved pre-registration law trends are driving the results on the registration law generally, one would expect statistically insignificant coefficients for the registration law variable and the interaction term. This is confirmed by the results in the last column of Table 6.

5.2.3. Different groups and other checks

So far the results have focused on average effects for all children. However, it is possible that the effects varied by race or geography.

Firstly, laws may have been less well enforced for black children, or black children may have been less likely to be registered due to weaker access to health care. Columns (1) and (2) of Table 7 refer to estimates for samples of white and black children separately. The minimum age limit had no effect on the employment of black children, regardless of registration laws.²⁸ It did affect the employment of white children, and was more effective for white children born with a birth registration law.

Secondly, child labor laws may not have been applicable to agricultural activities or cases where the

child was employed by parents, although the coverage of these laws did vary across states.²⁹ In rural areas, a significant share of children worked without pay on the family farm (65% of U.S. born 12–15 year old workers in rural areas between 1910 and 1930). Thus, the focus on the use of birth certificates for obtaining work permits may not be as relevant. There is also a potential concern over the over-reporting of child labor in 1910, specifically for agricultural workers (see footnote 18). Moehling (1999) restricts her analysis to children in non-agricultural households.³⁰ In columns (3) and (4), children are divided into 'farm' and 'non-farm' households.³¹ In columns (5) and (6) children are divided based on the average share of all employed individuals working in agriculture in the child's county of residence in 1910 (below or equal to 50% and above 50%).

²⁹ Some states had exemptions for hardship, especially in the South (see Hindman, 2009, p. 483), or for children working in establishments owned by their parents (see e.g. Riney-Kehrberg, 2001, p. 59). As one concrete example, Riney-Kehrberg (p. 58–59) notes that around 1920 in Illinois, under 14-year olds were prohibited from "any gainful occupation in, or in connection, with factories, canneries, stores, etc., at any time, or in any work for compensation during the school term." However, according to Goldmark (1907), in 1907 there were several states where anyone below 14 years of age was prohibited from all employment during school hours.

³⁰ In Moehling's study, agricultural households are "farm" households, or those where the child's family head had an agricultural occupation.

³¹ In 1910 and 1920, 'farm' households were those located on either a tract of 3 or more acres used for any agricultural operations, or on a tract of fewer than 3 acres that either yielded \$250+ in produce sales in the previous year or employed at least one full-time farmer or agricultural laborer. In 1930, all households living in a house on a farm were considered farm households.

²⁸ The models do not include state trends as they could not be estimated with such for the black sub-sample.

With respect to children born before the registration laws, the results show that the under-aged residing outside farms, or in non-agricultural counties, were less likely to work than those living on farms or in agricultural counties. The interaction term between the registration law and the child labor law is negative for both farm and non-farm children. This is also the case for children in agricultural and non-agricultural areas, but it is not statistically significant at the 95% level for “agricultural” children. In general, the minimum working age reduced the employment of children in agricultural areas less, and the enforcement effect of the registration laws was not as strong for agricultural children.

In addition to these specifications, separate models were estimated for 6–11 and 16–18 year olds.³² Robustness to functional form was investigated by estimating the core specification both with a linear probability model and a household fixed effects linear probability models.³³

Finally, to investigate the sensitivity of the results, the models were estimated with alternative versions of the legal variables.³⁴ Both birth year and the registration

status of children are measured with some error. Since the registration laws were enacted during a specific year, children born prior to this part of the year may not have been registered. However, the census does not include data on the month of birth. Secondly, for some children, in particular in 1910 and 1930, the birth year will be equal to “census year – age” rather than “census year – age – 1”. To check whether the results remain robust to possible alternative definitions, separate models were estimated with birth year defined as “census year – age” and with the assumption that the registration law became effective in the year following the implementation year in all states. These alternatives lead to rather small changes in the proportions of children born with a registration law and the results remain similar. The results are available on request.

6. Birth registration laws and education

The analysis has so far focused on child labor as the outcome of interest, given that this is the direct target of minimum working age legislation. However, it would be of interest to know whether the reduced likelihood of under-aged employment translates into an increased likelihood of school attendance, with the potential for increased educational attainment. This could have longer term welfare implications. Secondly, the ability to confirm age with birth certificates may have improved, not just the enforcement of the minimum working age law, but also the enforcement of compulsory schooling age laws.

6.1. School attendance and birth registration

To assess whether the connection between the birth registration law and the minimum working legislation had implications for schooling, a regression model with reported school attendance as the dependent variable is estimated for 12–15 year olds with the pooled 1910–1930 sample. The model is otherwise identical to the core model specification in Table 5. The 1910–1930 censuses include a variable on whether children attended school, or were enrolled in school, any time since September in the previous year. Since the census dates varied, the reference time varies from within past 4 months to within past 7.5 months in the three samples. Data on months of school attended are not available in these censuses.³⁵ As acknowledged for instance by

³² The coefficient for the child labor law dummy could not be estimated due to a lack of variation for 16–18 year olds. The coefficient for the registration law alone was statistically insignificant. The coefficients for the legal variables were also statistically insignificant for 6–11 year olds. These results lend support to the conclusion that birth registration played an enforcement role specifically for 12–15 year olds. The results are available on request.

³³ In the pooled linear probability models without household fixed effects, the interaction effect was not significant with the 1910–1930 sample, but was significantly negative with the 1910–1920 sample. The child labor law dummy had a statistically significant negative coefficient in both cases. However, the interaction effect was significantly negative when a linear probability model with household fixed effects model was estimated, although the coefficients for the legal variables were smaller in size than in the pooled Logit models. It should be noted that in the fixed effects models, the within household variation in the birth registration law variable is derived from a limited set of households with multiple children between the ages of 12–15. The results are available on request.

³⁴ Firstly, a model that included a dummy variable for whether the state of residence had a minimum working age law was estimated. The coefficient for this variable was significantly positive, but the coefficients for the other legal variables were not affected. Secondly, the models were estimated with an alternative child labor indicator that incorporated the length of schooling requirements. The legal minimum working age was determined as in Manacorda (2006): $\text{Max}\{\text{legal minimum working age}_{st}, \text{legal school entry age}_{st} + \text{years of education required for a work permit}_{st}\}$, where s refers to the child's state of residence and t to the census year. The data came from Goldin and Katz (2011). The value for the school entry age is the prevailing legal age in the child's current state of residence when the child was 7 years old. If there was no minimum schooling requirement for a work permit, the minimum age for a work permit is used (if such existed). Again, the conclusions on the laws remained unchanged. The results are available on request.

³⁵ In principle, the 1950 occupational classification includes a category for “student”, but there are next to no entries in this occupational category in the 1910–1930 censuses.

Moehling (2004), this variable does not capture regular attendance well, and the figures are closer to enrolment. In the sample of 12–15 year olds used in Section 5, the reported school attendance rates were 0.87, 0.90 and 0.91 for 1910, 1920 and 1930 respectively.³⁶

The results, shown in the first column (1) of Table 8, confirm that the minimum working age law affected the likelihood of school attendance and the positive effect was larger with registration laws. Under-aged children born before the registration law were 3.6 percentage points more likely to attend school than the work-eligible. Those born with a birth registration law were 6.5 percentage points more likely to attend school.

To analyze the relevance of birth registration for compulsory schooling laws, a few additional models are estimated. As a direct comparison with the results of model (1) on the minimum working age, the same pooled model specification for 12–15 year olds is estimated with the compulsory schooling law dummy variable (*'school law'*) as opposed to the child labor law variable. The results in column (2) indicate that school-aged children were 2 percentage points more likely to attend school than those outside the compulsory age range when they had been born with a registration law in place. The registration law does not have an independent effect on the attendance of children outside the compulsory schooling range.

A comparison of the results in columns (1) and (2) implies that for the 12–15 age range, the minimum working age was a more relevant constraint than the legal school leaving age, as suggested for instance by Goldin and Katz (2011). This is confirmed by the results in column (3), which includes both the schooling and child labor law variables and interaction terms with the registration law variable. Only the coefficients for the child labor law dummy and its interaction term are statistically significant and resemble those in column (1).³⁷

Column (4) shows the results of a model for 6–11 year olds. The variation in the schooling law dummy is driven mainly by the legal school entry age (6–11 year olds). The share of U.S. born 6–11 year olds within the compulsory schooling age range was 0.58, 0.71 and 0.78

Table 8

Dependent variable: Likelihood that child attends school.

Pooled Logit models				
	Age: 12–15			Age: 6–11
	(1)	(2)	(3)	(4)
Registration law	.005 [.008]	–.003 [.009]	–.001 [.009]	–.008 [.007]
Child labor law	.036 [.008]**		.037 [.008]**	
Child labor law × Registration law	.029 [.009]**		.028 [.009]**	
School law		–.012 [.008]	–.002 [.008]	–.008 [.006]
School law × Registration law		.020 [.009]*	.009 [.009]	.030 [.006]**
Obs.	238,399	238,399	238,399	381,398
State of birth trends	Yes	Yes	Yes	Yes
Log-likelihood	–69,001	–69,001	–68,774	–105,069

**, * Significant at the 1 and 5% levels respectively. Estimated coefficients are average marginal effects. The sample includes U.S.-born individuals. The models include dummies for gender, race (black and other non-white), birth cohort, state of birth and state of residence. Standard errors (in brackets) are clustered at the state of birth × cohort level. A Wald test is used to test for statistical significance.

for 1910, 1920 and 1930 respectively. The share of children in this age group who reported attending school was 0.86, 0.91 and 0.88 for 1910, 1920 and 1930 respectively. The results show that in the 6–11 year age group, school-aged children were more likely to attend school than those outside the compulsory schooling age range only if they had been born with a registration law in place. The estimated effect corresponds to a 3 percentage point difference in the likelihood of school attendance. This suggests that the age requirements for younger children were somewhat better enforced with official proof of age. Given the lack of variation in the child labor law dummy for 6–11 year olds, this variable is not included in the models.

Overall, there is some evidence that birth registration laws improved the enforcement of compulsory schooling laws, in particular regarding the school entry age. For the 12–15 year age group, the minimum working age appears to have been a more relevant factor for school attendance than the school leaving age. The effects of the schooling laws may appear weak, or small, since the reported attendance rates are fairly high, although they are unlikely to capture regular attendance accurately.

6.2. Educational attainment and birth registration

Some of the research on the effects of child labor and compulsory schooling laws in the U.S. has taken a retrospective approach by analyzing the contribution

³⁶ A significant share of children who reported having an occupation in the pooled data, also reported having attended school (60–66%), which implies that children either attended school irregularly, or worked outside school hours. They may have attended continuation school. (see Section on educational attainment below for details).

³⁷ The conclusions would remain similar with an alternative indicator for the compulsory schooling age, that utilizes the requirement on years of education to be completed for an exemption (similar to alternative child labor law indicator).

of the laws to educational attainment of adults. Goldin and Katz (2011) and Lleras-Muney (2002) both use the 1960 census. This section utilizes a similar estimation framework, incorporating birth registration laws as an additional dimension. It also relies on the 1% sample of the 1960 U.S. census (Ruggles et al., 2010).

The 1960 census includes data on the quarter of birth and age, which are used to calculate the birth year of a child, and determine whether the individual was born with a birth registration law in place or not. With respect to the child labor and schooling law variables, for comparability this section relies on similar indicators as Goldin and Katz (2011). These are indicators on the length of schooling required for work, or for an exemption from school. They are based on the required legal age, but also on the requirements on the years of schooling to be completed for work, or for an exemption from the maximum schooling age rule (see Section 2).³⁸ Following Goldin and Katz (2011), the length of schooling indicators used are defined as

- (2) Child labor school years_{*t*} = max{(years of education required for work permit_{*t*}), (minimum working age_{*t*} — legal school entry age_{*t-7*})}
- (3) Compulsory school years_{*t*} = min{(years of education for exemption from school_{*t*}), (legal school leaving age_{*t*} — legal school entry age_{*t-7*})}

In both, *t* is the year in which the individual is 14 years old and the laws are those applicable in the state of birth. If one of the components in Eqs. (2) or (3) gets a value of zero, indicating that there is no requirement, the value of the other indicator is used, if it is above zero.³⁹ The two indicators correlate highly with each other in the regression sample (0.72), so are mostly not included in the same model.

As in Goldin and Katz (2011), the estimated models rely on a sample of individuals born between 1896 and 1925. The data on child labor laws and schooling laws are available for 1910–1939. Those born in 1896 would have been 14 in 1910, and therefore this is the first cohort examined.

If child labor and schooling requirements affected schooling decisions, a longer educational requirement could be expected to increase the years of schooling. In comparison with those born before a birth registration

law, individuals born with a birth registration law could be expected to be more likely to enter school at the required age and to stay in school until the minimum legal leaving age (either based on the working age or schooling age, depending on which was the true binding constraint). Therefore, better enforcement of the age requirements could be expected to lengthen the time spent in school.⁴⁰ In the sample of individuals born in the U.S. between 1896 and 1925, only 4% lived in a state without a length of schooling requirement as defined above when they were 14.

We might assume that regardless of the age requirement, children reluctant to attend school would be able to falsify their age by a fairly fixed margin, not larger than a few years. Children beyond this margin would be physically identifiable as over, or under-aged. The effect of the birth registration law on educational attainment would thus not be expected to vary depending on the length of schooling requirement. It would not be appropriately captured with an interaction term with the required years of schooling, but would rather be expected to be a positive constant across the required years. The results of models based on this assumption are presented first, followed by models testing for the presence of a non-linear effect, conditional on the required length of schooling. An inherent limitation of the modeling approach is that it cannot determine whether any effect of birth registration laws on attainment is the result of improved enforcement of the age requirements, or another factor, such as improved educational planning.

The following OLS model is estimated for the sample of individual to whom the age laws applied:

$$ED_i = \alpha_0 + \alpha_1 R_{bc} + \alpha_2 C_{bc} + \alpha_3 S_{bc} + \alpha_4 CN_{bc} + \alpha_4 NO_C_{bc} + \alpha_4 NO_S_{bc} + Z_i' \beta + \gamma_b + \delta_{r \times c} + \varepsilon_i \quad (4)$$

where *i* refers to an individual, *b* to the state of birth, *c* to the birth cohort and *r* to the census region of birth. *ED_i* refers to the years of education completed, *C_{bc}* refers to the “child labor school years” and *S_{bc}* to the “compulsory school years”, *R_{bc}* refers to a dummy variable for whether the child is born with a registration law in place, *NO_C_{bc}* and *NO_S_{bc}* refer to dummy variables for “no child labor school years” and “no compulsory school years”. *Z_i* refers to a vector of control variables, namely gender and race. The models now also include a dummy variable for whether the

³⁸ The alternative would be to use variables on the legal school entry and leaving age, or minimum working age, simultaneously in one model. The choice of child labor and schooling law variables does not alter the conclusions regarding the effects of the birth registration law.

³⁹ A “read and write” requirement is considered equivalent to four years of schooling, as in Goldin and Katz (2011).

⁴⁰ The results earlier indicated that registration laws largely did not facilitate the employment of children above the minimum working age, or lower the attendance of children below the school entry age.

Table 9

Summary statistics for the 1960 sample (birth cohorts: 1896–1925).

	Obs. 545,424	
	Mean	St. dev.
Education in years	10.06	3.47
White*	.90	.80
Black*	.10	.29
Other non-white*	.003	.06
Female*	.51	.50
Child labor school years	6.75	1.78
Compulsory school years	7.34	2.09
No child labor school years*	.04	.20
No compulsory school years*	.04	.20
Continuation schooling law*	.47	.50
Registration law*	0.70	0.46

The sample includes U.S. born individuals, in 48 states. * = dummy variables. Registration law = dummy variable that takes a value of 1 when the individual was born during, or after, the year of the birth registration law. Continuation schooling law is a dummy variable with a value of one if the state of birth had a continuation schooling law when the individual was 14 years old. ‘Child labor school years’ and ‘Compulsory school years’ are defined in Section 6.2.

state of birth had a continuation schooling law when the individual was 14 years old (CN_{bc}), given that this has been studied in previous research and could affect attainment. These laws applied to working children below the legal school leaving age, and required them to attend school, generally for four to eight hours per week (see Goldin and Katz, 2011). In the sample, for the 1896 cohort, no birth states had such a law, but the prevalence increased steadily over time, covering 64% of the 1925 birth cohort.

The coefficient sets γ_b and $\delta_{r \times c}$ refer to state of birth effects and region of birth specific cohort effects (census region of birth \times cohort) respectively. There are four census regions (Northeast, South, West and Midwest). The latter control for the possibility that developments in educational attainment varied by census region. They are included in the specifications in Lleras-Muney (2002), who uses the 1960 census. Goldin and Katz (2011) report the results of models that include trends for each of the nine U.S. census divisions, but note that their results are robust to the inclusion of census region-year effects instead, although slightly attenuated.

The models are estimated across the entire educational distribution. The summary statistics for the variables of interest are reported in Table 9. The results of the regression models are shown in Table 10. The discussion focuses on the effects of the birth registration law.

The model in column (1) includes the registration law dummy as the only explanatory legal variable. The results indicate that the birth registration law was related to educational attainment; those born with the law in place had on average 0.08 more years of education.

In the next columns (2 and 3), the models include the child labor schooling years and compulsory schooling year indicators respectively as well as the relevant dummy variables for no such laws. The coefficients for no laws are not shown to simplify exposition. Column (4) shows the results of a model that includes all four indicators simultaneously. In all models, the coefficients for the birth registration dummy remain significant with a fairly similar coefficient, between 0.08 and 0.10. Child labor schooling years have a statistically

Table 10

Years of education in 1960 (birth cohorts: 1896–1925), OLS.

	(1)	(2)	(3)	(4)	(5)	(6)
Registration law	.083 [.021]**	.088 [.021]**	.095 [.021]**	.078 [.021]**	.062 [.024]**	.103 [.031]**
Child labor school years (CLSY)		.054 [.010]**		.073 [.011]**	.039 [.012]**	
Compulsory school years (CSY)			-.012 [.006]	-.027 [.007]**		-.011 [.007]
Continuation school		.118 [.028]**	.124 [.027]**	.121 [.028]**	.123 [.028]**	.124 [.027]**
Registration law \times CLSY ≥ 7					.063 [.027]*	
Registration law \times CSY ≥ 7						-.012 [.032]
Obs.	545,424	545,424	545,424	545,424	545,424	545,424
Region of birth \times cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.15	0.15	0.15	0.15	0.15	0.15

**, * Significant at the 1 and 5% levels respectively. Sample: Table 9. Standard errors (brackets) are clustered at the state of birth \times cohort level. All models include dummies for gender, race (black, other non-white) and state of birth. Columns (2) and (5) include a dummy variable for “no child labor school years”, columns (3) and (6) for “no compulsory school years” and column (4) includes dummies for both.

significant positive relationship with educational attainment. The coefficient for compulsory schooling years is insignificant in model (3), but becomes statistically significantly negative in model (4), possibly due to the high correlation between the two variables on the length of schooling.

The last two columns show the results of models used to test whether the effect of the registration law varies by required schooling years. To simplify interpretation, the presence of a non-linear effect is tested using an interaction term between the registration law dummy and a dummy variable for whether the required number of school years is seven or above.⁴¹ The cut-off point of seven years is chosen as it represents the average value for both school year requirements. This interaction term is statistically significant in column (5), but not in column (6). The results indicate that for a child labor school years below seven years, those born with a registration law had 0.06 more years of schooling. However, for seven or more child labor school years, those born with a registration law had 0.125 more years of schooling. This tells us that there is potential heterogeneity in the effect of the registration law on educational attainment, and that this heterogeneity can be due to schooling institutions of the state.

Overall, the results indicate that individuals born with a registration law, had on average 0.08–0.10 more years of education. The effect of registration laws may have depended on the length of the schooling requirement. It can be noted that the results on birth registration laws would also be robust to a specification that includes cohort dummies and census division trends as in [Goldin and Katz \(2011\)](#).⁴² However, it may be questionable whether a linear trend is appropriate to cover birth cohorts spanning 30 years.

The results in [Table 10](#) do not definitively identify the channel, but based on all the evidence, the likely explanation is the improved enforcement of the legal age requirements. For individuals born in the U.S. between 1896 and 1925, the average educational attainment increased from 8.7 to 11 years. The coverage of the

registration law increased from 25 to 100% for the same cohorts. Thus, a 0.09 year increase in attainment due to the birth registration laws would account for 3% [$0.09 \times (1 - 0.25) / (11 - 8.7)$] of the total increase.

7. Conclusions

Birth registration has been a little explored topic by economists and a neglected aspect in the study of the effects of legislation that specifies age limits or age requirements. This study provides evidence that state-level laws on birth registration substantially improved the enforcement of minimum working age legislation and to some extent also compulsory schooling legislation in early 20th century USA. The suggested channel of effect is the use of birth certificates as formal proof of age. It is also shown that birth registration laws had long-term implications by raising educational attainment. To the author's knowledge, this is the first study to provide statistical evidence on the effects of birth registration laws in the USA.

The identification of the legal effects has relied on a framework that controls for state and birth cohort effects. Therefore, any time invariant, state-specific and cohort-specific characteristics that might correlate with the timing of the birth registration laws have been controlled for. Most models also control for state of birth specific linear trends. The results remain robust to the inclusion of time-varying control variables, both at the household and state-level. It is important to stress that the study focuses on the effects of birth registration laws. Given that birth registration coverage was not complete since the enactment of the registration laws, it is possible that the study still underestimates the effect of birth registration.

The results of the pooled models with a sample of 12–15 year olds for 1910–1930 show that the minimum working age legislation was more effective in reducing the likelihood of under-aged employment when children had been born with a birth registration law in place. On aggregate, between 1910 and 1930, under-aged children born with a registration law in place were around 9 percentage points less likely to work than work-eligible children. When they had been born prior to a birth registration law, under-aged children were around 3–4 percentage points less likely to work than work-eligible children. Therefore, birth registration at least doubled the effectiveness of minimum working age legislation. Census-specific estimations suggest that the results are driven by the 1910 and 1920 censuses. By 1930, the incidence of child labor had fallen to a low level, and minimum working age legislation was less relevant. The

⁴¹ An alternative would be to specify the interaction term with the continuous variables for required schooling years. However the interpretation of such a model would be complicated by zero outlier values in the variables for required schooling years, given the small share of individuals to whom no such requirements applied.

⁴² In [Goldin and Katz \(2011\)](#), the significance of 'child labor school years' varies by model specification, whereas 'compulsory school years' is not statistically significant. In [Lleras-Muney \(2002\)](#), the legal variables are defined slightly differently, but the effect of the equivalent of child labor school years is around 0.05 years, whereas the equivalent of compulsory school years is not statistically significant; findings that are similar to those of this study (see column 2 of [Table 10](#)).

minimum working age limit did not affect the likelihood of employment of black children, irrespective of birth registration laws. Birth registration laws enhanced the effectiveness of the minimum working age legislation for white children, and the enforcement effects were also stronger for children in non-agricultural areas.

The results also confirm that the connection between birth registration laws and minimum working age legislation had implications for the school attendance of 12–15 year olds. Children below the minimum working age were generally more likely to report attending school than work-eligible children, but even more likely to do so when born with a birth registration law.

With respect to compulsory schooling requirements, the findings indicate that the school leaving age was not necessarily a constraint for employment and schooling decisions of 12–15 year olds. However, in a sample of younger children (6–11), those within the compulsory schooling age range were 3 percentage points more likely to attend school than those outside the range, but only when they had been born with a birth registration law. However, the data on school attendance does not capture regular attendance well and the reported school attendance rates are rather high. The analysis with the 1960 census shows that individuals born with a birth registration law in place had approximately 0.1 more years of education than those born without. Considering all the evidence, this is likely to be explained by the improved enforcement of the laws on minimum working and compulsory schooling age.

Overall, the results imply that legal age requirements are more likely to be enforced with a functioning birth registration system in place. The neglect of birth registration as an enforcement institution may affect estimates of the significance of minimum working age, or compulsory schooling age laws, as well as other laws that specify age requirements. This could explain why some of the previous historical studies in the U.S. context have found relatively small effects of such laws on child labor or educational attainment. This study has a historical focus, but the questions addressed remain relevant for today's developing countries.

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Appendix 1. Birth registration laws

1.1. Data sources

For general developments in birth registration, the two key sources used are a comprehensive report on the developments in U.S. vital statistics by the National Center for Health Statistics (Hetzel, 1997) and an article by Shapiro (1950). These do not include years for state-specific registration laws.

Several sources have been used for the year of the birth registration laws in each state. This represents the year when birth registration became mandatory across the state and procedures were established to register birth across the state, assemble these records centrally and produce statewide records of births. The first source is Nichols (1980), which includes the years when a law making birth registration mandatory at the state-level was enacted in each state. For most cases, simply the year, and not the month of the year, is included. Nichols collected the information by contacting the Bureau of Vital Statistics in each state through a phone survey. The information collected was then verified, signed and returned by the bureaus. Nichols presents the years for the birth registration laws for each state in a table, but also includes a separate discussion for each state. The year of the law is not unambiguous in every case.

A reference book by Eichholz (2004) was used to confirm some details. The book contains state-specific entries on the history of vital records in each state, in particular on when state-level registration of births and deaths started in each state. In this source, the discussion can be located for each state under the section "Vital Records".

A report titled "Where to Write for Vital Records" by the National Center for Health Statistics/CDC (2013) is used as a source for the dates since when the Office of Vital Statistics in each state holds records of births. It indicates the time since when birth records in practice became available at the state level. For some states, current websites of State Departments of Health were consulted for this information. These sources are listed in the notes to Table 1 and in the discussion below.

Historical reports from the State Boards (or Departments) of Health for a period directly before and after the enactment of the state registration law were also explored for several states. These provided more detailed information on the developments in registration practices, and could be used to confirm the year of the law in several

cases (see references for specific sources). The Boards of Health were responsible for compiling statewide vital records at the time. For many states, the reports confirm that the laws marked a clear change in the registration procedures and registration coverage. Relevant extracts from the reports are shown and discussed further below.

Generally, the year of the relevant birth registration law can be established without much ambiguity. In most cases, this is also the year from which onwards state offices hold records of birth. However, in some cases, more judgment is required than in others. Notes for specific states are included below. Some states enacted some forms of registration laws earlier, but they were repealed, or ineffective in establishing statewide registration, with very few records available. The year of the more effective law generally corresponds to the year from which onwards records are available at the state level. In some states, specific towns, or counties kept records, but the coverage varied and there was no centralized register, or process for assembling records at the state-level.

In the regression analysis, a few robustness checks are conducted either with slight changes to the year of the law for a few specific states (see state-specific discussion below) or using the year since when records are available at the State Vital Statistics offices.

1.2. Discussion for specific states

States, for which it was straightforward to determine the relevant year of the state registration law:

Alabama, Arizona, Arkansas, California, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Washington, Wisconsin, Wyoming.

Other states:

Colorado: According to Eichholz, the first law for the registration of birth and deaths was enacted in 1875, but compliance was “sporadic and minimal” and statewide registration of births began in 1910. Records of births are available from 1910 in the state vital statistics office. Nichols reports 1907 as the year of the law, but notes that generally registration began in 1910. A Board of Health report for 1908/09 confirms initial problems with the recording of births due to a lack of forms, explaining the delay (p. 4, Colorado State Board of Health). Therefore, 1910 is considered as the year when statewide registration started.

Connecticut: According to Eichholz, the recording of births has always been the responsibility of the town and started early (1650). But, according to a law in 1897, copies of vital records from every town were to be sent to the Department of Health, which established statewide recording practices. Records are available at the State Vital Records Office from 1897. The annual report of the State Board of Health for 1890 (p. 11–13, Connecticut State Board of Health) does suggest that records had been collected since 1848, but that these were deficient. It also identifies deficiencies in the existing recording system (as of 1890) and difficulties in utilizing records centrally, as they were scattered across towns. It can be noted that the results of this study would remain robust to using 1848 as the year of the law.

Delaware: Nichols provides three separate years for a law. The first law was enacted in 1861, but repealed after two years. The next law was enacted in 1881, but was not considered very effective. Finally, 1913 is listed as the year when the Bureau of Vital Statistics was created and a corresponding law enacted. Eichholz notes that besides the city of Wilmington, “recording practices were quite poor until the creation of the vital statistics office in 1913”. Records are available in the Vital Statistics Office mainly from 1913. Therefore, 1913 is considered as the year of the law.

Florida: According to Nichols, the first law in Florida was passed in 1899, but it included no penalties. The Bureau of Statistics has records mainly from 1917, with some records available from 1865. The annual report of the Florida State Board of Health, 1916 (p. 203) confirms that a state registration law became effective from the 31st of December 1916. Therefore, 1917 is considered as the year of the relevant law. However, as discussed in more detail below, according to the annual report of the Florida State Board of Health, 1915, the enactment of the law was a process and counties were already reacting in 1915 with significant registration activity. It can be noted that the results of this study would remain robust to using 1915 as the year of the law.

Idaho: According to both Eichholz and Nichols, since 1907 midwives and physicians were required to report births to county recorders, which explains why some records are available from 1907. Since 1911, births had to be reported directly to the state. Records are available in the state office mainly from 1911. 1911 is considered as the year of the law.

Louisiana: According to Eichholz, statewide registration of births began in 1914, when the Bureau of Vital Statistics was created. The year of the law

in Nichols is 1918. The website of the state of Louisiana (http://www.prd.doa.louisiana.gov/laservices/publicpages/ServiceDetail.cfm?service_id=3311) indicates that the Louisiana Vital Records Registry holds birth records from 1907. There is some uncertainty regarding the appropriate year and the decision was made to choose 1914 as the relevant year.

Minnesota: Nichols shows 1908 as the year when birth registration was required by law at the state-level. According to Eichholz, the Vital Records law was enacted in 1907. Further discussion in Nichols suggests that the first law was passed already in 1872, but that it was not effective. Records are available in the state office from 1900. According to Nichols these were ‘sketchy’ until 1907. However, the second Biennial Report of the Minnesota State Board of Health (1888/89) (p. 3–4) includes the text of the Vital Statistics Law for 1887 and the discussion indicates that vital records had been collected through the State Board of Health since 1887. The Biennial Report of the Minnesota State Board of Health for 1911/12 (p. 5) notes that the law was revised in 1907 so that the records were kept in the State office and not sent back to the counties, but this did not change practices much. The decision was made to use 1887 as the year of the relevant law. It can be noted that the results of this study would remain robust to using 1907 as the year of the law.

New Hampshire: According to Eichholz, recording of vital events has been the responsibility of cities/towns, but an 1866 law required copies to be sent to the state, although compliance was incomplete until 1880 s. Nichols reports that a 1883 law was considered instrumental for achieving more complete registration. Some birth records are available already from 1640. The year chosen does not make a difference for the econometric analysis, as everyone would be considered to have been born with a registration law, and therefore 1883 is chosen.

New Jersey: According to Eichholz, statewide recording began already in 1848, whereas according to Nichols, it began in 1878. Records of births are reported to be available from 1848. For the purposes of the econometric analysis, it is irrelevant which year is chosen, as all children in the sample would have been born with a birth registration law in any case. The earlier year is chosen.

New York: The table in Nichols shows 1915 as the year since when birth registration was required by law at the state-level. However, the discussion states that a state-level registration law was enacted in 1880, but it did not include penalties for non-compliance. Eichholz

(2004) also mentions 1880 as the year of the law. Records of birth are available in the state office since 1881 and according to the website of the New York State Department of Health (http://www.health.ny.gov/vital_records/genealogy.htm), the recording of vital events started in 1881, which is chosen as the year. According to both Eichholz and Nichols, state procedures did not cover New York City, or Albany, Buffalo and Yonkers prior to 1914, which had their own registration procedures. However, as the census data do not include information on the place of birth, other than the state, this aspect cannot be considered in the analysis.

North Dakota: The date coded in Nichols’ table as the year of the law is 1907, when North Dakota passed the Model Vital Statistics Act, which requires individual birth certificates to be issued. The biennial report of the North Dakota State Board of Health for 1907–1908 confirms that a state-level law was enacted in 1907, but it came into force in January 1908. (p. 46–47). Therefore, 1908 is considered as the year of the law.

Oklahoma: Both Eichholz and Nichols note that statewide recording started in 1908, but recording was far from complete and a law making registration mandatory was passed in 1917. This is confirmed on the website of the Oklahoma State Department of Health (http://www.ok.gov/health/Birth_and_Death_Certificates/Birth_Certificates/index.html). Therefore, 1917 is considered the year of the law making registration compulsory.

Rhode Island: According to Eichholz, statewide recording began in 1853. Nichols mentions 1896 as the year of the state birth registration law. However, she also mentions that the Division of Vital statistics holds records of births from 1853 onwards. The decision was made to choose 1853 as the relevant year.

South Dakota: The table in Nichols shows 1920 as the year when birth registration was required by law at the state-level. However, the discussion notes that a state law was also passed in 1905, but it did not include penalties for non-compliance. Eichholz also describes 1905 as the year when statewide recording began and this is also the year from which records are available in the state office. Therefore, 1905 is considered as the year of the law.

Vermont: Described by Nichols as a state where statewide records of births and deaths were reasonably complete already by 1800. According to Eichholz (2004), and confirmed by information on the website of the Vermont Department of Health, (http://healthvermont.gov/research/records/vital_records.aspx),

registration at the state-level began in 1857, which is the year used in this study.

Virginia: According to both Eichholz and Nichols, the state recorded births between 1853–1896, but reporting was incomplete. The law ended in 1896, and a new one was not enacted prior to 1912. Records are available in the state office for 1853–1896 and from 1912. Therefore, 1912 is considered the year of the law.

West Virginia: State registration of births started in West Virginia in 1917, but was not compulsory by law prior to 1925. The annual report of the State Health Department of West Virginia for 1919/1920 indicates efforts to record vital statistics (e.g. p. 8), but also stresses the need for a law to improve recording (p. 11). Similarly as in the case of Oklahoma, the year when recording became compulsory by law is chosen. Indiana, Mississippi, North Carolina, Ohio and Wisconsin are states where according to Nichols, the law came into force late in the year (October–December). In these cases, it is assumed that the law became effective in the following year.

1.3. Enforcement of registration laws

This section documents a few extracts from the reports of the State Boards of Health regarding the implementation and enforcement of registration (vital statistics) laws. The focus is on the recording of births. The purpose is to demonstrate that the registration law was considered to represent a considerable change in registration practices. Reports were examined for years directly preceding and following the registration law for a large number of states (31), but precisely relevant reports could not be located for all, or they did not contain relevant information on enforcement and registration practices around the year of the law.

California: California enacted a registration law in 1905 to organize the collection of vital statistics at the state level. There had been a previous attempt at a law, but extracts from the 1906 Report of the State Board of Health imply that the 1905 law in many ways established procedures for registration at the state level: "...a law was enacted creating a department in the State Board of Health to be known as a Bureau of Vital Statistics, for the complete and proper registration of births, marriages, and deaths, for legal, sanitary, and statistical purposes...The former law relating to the collection of vital statistics had never been enforced to any extent". (p. 11)

"The law took effect in May 18 1905, but owing to a delay in getting blanks, the bureau was not in active operation until a month later. Since that time, however,

it has gone steadily forward, not without some friction, but with steadily increasing accuracy." (p. 11).

Florida: According to the 1915 State Board of Health report, a state level vital statistics bill was enacted in 1915 (p. 44). However, according to the 1916 report, the state registration law in Florida became operational on the 31st of December 1916 (p. 203). However, municipalities had already started to take action in 1915. The 1915 report indicates clear improvements in registration: "Vital Statistics in Florida has in the past year made greater advancement than ever before. In 1899 the State Legislature passed a law creating a Bureau of Vital Statistics, but it was very defective, and after several years in which only spasmodic efforts were made for its enforcement, it dropped into disuse, and from 1905 to 1913 Florida had practically no reported vital statistics, worth recording...During the first part of 1915 a vigorous campaign was waged with the purpose in view of having the Model Ordinance, which is wholly in accord with the Model Vital Statistics Law, passed by as many of the municipalities as possible... The result of this campaign was that during 1915 sixty-six municipalities passed the Model Ordinance and began the collection of Vital Statistics, making a total of 118 complying with this ordinance, and of which 19 are reporting with fair regularity. In most cases the reports cover approximately 90% of the births and deaths occurring." (p.43–44).

Kansas: A state registration law was enacted in 1911. The sixth biennial report for 1911/12 discusses the operation of the law: "In accordance with the instructions of the state board of health, the law known as the vital statistics law was put into actual operation in August, and reports for the half of August and the first week in September indicate that the law is reasonably well enforced, and in a more satisfactory manner than was anticipated." (p. 65)

Maine: The state registration law was enacted in 1892. According to the Board of Health Report for 1892: "As under the old law, repealed in 1887, but one or two dozen town clerks annually complied with the statutory provisions, requiring reports of births, marriages, and deaths to be made to the secretary of state, there were perhaps grounds for the apprehension that there would be some difficulty in getting returns from all the towns, but it is gratifying to be able to report that a large majority of the clerks made their returns very promptly, and that eventually returns were received from every city, town and plantation in the State save one town; and from that a clear statement of the number of births marriages and deaths was received." (p. 5)

Maryland: The registration law was enacted 1898.

The 1897 State Board of Health report states:

“It has for some years been the practice of the State Board of Health to provide the practicing physicians of Maryland with printed post cards for returns of births, deaths and diseases. Of the large numbers sent out, but a trifling fraction came back to the State Board of Health, while of these returning few, only a moiety bore such information as was sought.” (p. 57) In the same report, many annual accounts by county health officers indicate that no vital records had been collected. For example, the Allegany county health officer reports: “As to statistics, we have no registration of births...I would be glad to see enacted a much more stringent State Health Law by the coming legislature.” (p. 70).

However, in the 1899 State Board of Health report, following the enactment of the registration law, the Allegany county health officer is in a position to provide numbers: “I find that I have registered 357 births and 128 deaths...” (p. 1 of “reports of the local health officers”)

Missouri: 1918 Board of Health report discusses the 1910 registration law and how registration operates: “Since February 1, 1910, this division has been in operation for the collection of birth and death statistics. In normal times there is received each year approximately 72,000 of the former and 43,000 of the latter.” (p. 8).

New Hampshire: A registration law was enacted in 1883. The tenth annual report of the State Board of Health 1891 states: “As a matter of fact, the registration of vital statistics in New Hampshire commenced about 10 years ago, and is yearly becoming more accurate and valuable.” (p. 15).

Nevada: The registration law was enacted in 1911. The 1912 Biennial Report of the State Board of Health states that

“During the session of 1911 the Legislature passed, with but one dissenting vote, a vital statistics law... Up to this time no reliable registration of births or deaths had been kept.” (p. 37).

“I am pleased to say that the local registrars in most of the counties have exhibited praiseworthy zeal in the discharge of their duties, so creditable, in fact, that I feel safe in saying that during the eighteen months since the law went into effect fully, 95% of births and deaths have been reported.” (p. 43).

North Dakota: The registration law was enacted in 1907, and came into force in 1908. According to the

Tenth Biennial report of the Board of Health for 1907/08:

“The last legislature passes Senate Bill No. 222, creating a Bureau of Vital Statistics. This made an entire revolution in the manner of collecting and reporting births and deaths.” (p. 46–47).

“It is gratifying to note that there has been a gradual and steady improvement in the registration of Vital Statistics since the new law went into effect Jan 1st 1908....We may therefore justly assume that at an early date North Dakota will have as complete registration statistics of its births and deaths as any state in the Union”. (p. 19).

According to the eleventh Biennial Report of the Board of Health for 1909/10, the number of births recorded almost doubled during the year that the law came into force (1908) and continued to rise in the following years:

“We have been able to make a steady advance in registration from year to year, as may be noted from the record for June”. For 1905, 1906, 1907, 1908, 1909 and 1910, these records show the following numbers of births: 343, 322, 335, 628, 709, 1017. (p. 20).

1.4. References for *Appendix 1* in order of appearance

Colorado State Board of Health, Ninth Biennial Report of the year 1908/09.

Connecticut State Board of Health, Thirteenth Annual Report for the year ending 30 November 1890.

Minnesota State Board of Health and Vital Statistics, Second Biennial Report, The Vital Statistics of the State of Minnesota for the years 1888–1889.

Minnesota State Board of Health and Vital Statistics, Fourth Biennial Report, 1911–1912.

Annual Report of the State Health Department of West Virginia, July 1919–June 1920.

Nineteenth Biennial Report of the State Board of Health of California State from July 1904 to June 1906

Florida State Board of Health. Twenty Seventh Annual Report for the year 1915.

Florida State Board of Health. Twenty Eighth Annual Report for the year 1916

Sixth Biennial Report of the State Board of Health of the State of Kansas from January 1911 to June 1912.

First Annual Report Upon the Births, Marriages, Divorces and Deaths in the State of Maine for the year ending December 1892.

Biennial Report of the State Board of Health of Maryland for the Two Years ending 31st December 1897.

Annual Report of the State Board of Health of Maryland for the Year ending 31st December 1899.

Thirty Sixth Annual Report of the State Board of Health of Missouri 1918.

Tenth Annual Report of the State Board of Health of the State of New Hampshire for the year ending October 1891.

State of Nevada. Biennial Report of the State Board of Health for Period ending December 31, 1912.

Tenth Biennial Report of the State Board of Health to the Governor of North Dakota for the years, 1907 and 1908.

Eleventh Biennial Report of the State Board of Health to the Governor of North Dakota. For the years 1909 and 1910.

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